Part M – The IMC, as Modified by Chapter Comm 64
TABLE OF CONTENTS

CHAPTER 2

DEFINITIONS

SECTION 201
GENERAL

201.1 Scope. Unless otherwise expressly stated, the following words and terms shall, for the purposes of this code, have the meanings indicated in this chapter.

201.2 Interchangeability. Words used in the present tense include the future; words in the masculine gender include the feminine and neuter; the singular number includes the plural and the plural, the singular.

201.3 Terms defined in other codes. Where terms are not defined in this code and are defined in the *International Building Code*, ICC *Electrical Code*, *International Fire Code*, *International Fuel Gas Code* or the *International Plumbing Code*, such terms shall have meanings ascribed to them as in those codes.

201.4 Terms not defined. Where terms are not defined through the methods authorized by this section, such terms shall have ordinarily accepted meanings such as the context implies.

SECTION 202
GENERAL DEFINITIONS

ABRASIVE MATERIALS. Moderately abrasive particulate in high concentrations, and highly abrasive particulate in moderate and high concentrations, such as alumina, bauxite, iron silicate, sand and slag.

ACCESS (TO). That which enables a device, appliance or equipment to be reached by ready access or by a means that first requires the removal or movement of a panel, door or similar obstruction [see also "Ready access (to)"].

AIR. All air supplied to mechanical equipment and appliances for combustion, ventilation, cooling, etc. Standard air is air at standard temperature and pressure, namely, 70°F (21°C) and 29.92 inches of mercury (101.3 kPa).

AIR CHANGE. The introduction of new, cleaned, or recirculated air to a space. [Comm 64.0202 (1) (a)]

AIR CHANGE RATE. Airflow in volume units per hour divided by the building space volume in identical volume units. [Comm 64.0202 (1) (b)]

AIR CONDITIONING. The treatment of air so as to control simultaneously the temperature, humidity, cleanness and distribution of the air to meet the requirements of a conditioned space.

AIR-CONDITIONING SYSTEM. A system that consists of heat exchangers, blowers, filters, supply, exhaust and return ducts, and shall include any apparatus installed in connection therewith.

AIR DISTRIBUTION SYSTEM. Any system of ducts, plenums and air-handling equipment that circulates air within a space or spaces and includes systems made up of one or more air-handling units.

AIR, EXHAUST. Air being removed from any space, appliance or piece of equipment and conveyed directly to the atmosphere by means of openings or ducts.

AIR-HANDLING UNIT. A blower or fan used for the purpose of distributing supply air to a room, space or area.

AIR, MAKEUP. Air that is provided to replace air being exhausted.

ALTERATION. A change in a mechanical system that involves an extension, addition or change to the arrangement, type or purpose of the original installation.

APPLIANCE. A device or apparatus that is manufactured and designed to utilize energy and for which this code provides specific requirements.

APPLIANCE, EXISTING. Any appliance regulated by this code which was legally installed prior to the effective date of this code, or for which a permit to install has been issued.

APPLIANCE TYPE.

High-heat appliance. Any appliance in which the products of combustion at the point of entrance to the flue under normal operating conditions have a temperature greater than 2,000°F (1093°C).

Low-heat appliance (residential appliance). Any appliance in which the products of combustion at the point of entrance to the flue under normal operating conditions have a temperature of 1,000°F (538°C) or less.

Medium-heat appliance. Any appliance in which the products of combustion at the point of entrance to the flue under normal operating conditions have a temperature of more than 1,000°F (538°C), but not greater than 2,000°F (1093°C).

APPLIANCE, VENTED. An appliance designed and installed in such a manner that all of the products of combustion are conveyed directly from the appliance to the outside atmosphere through an approved chimney or vent system.

APPROVED. Accepted by the department. [Comm 64.0202 (2) (a)]

AUTOMATIC BOILER. Any class of boiler that is equipped with the controls and limit devices specified in Chapter 10.

BASE FLOOD ELEVATION. A reference point, determined in accordance with the *International Building Code*, based on the depth or peak elevation of flooding, including wave height, which has a 1 percent (100-year flood) or greater chance of occurring in any given year.

BATHROOM. A room containing a bathtub, shower, spa or similar bathing fixture.

BOILER. A closed heating appliance intended to supply hot water or steam for space heating, processing or power purposes. Low-pressure boilers operate at pressures less than or equal to 15 pounds per square inch (psi) (103 kPa) for steam and 160 psi (1103 kPa) for water. High-pressure boilers operate at pressures exceeding those pressures.

BOILER ROOM. A room primarily utilized for the installation of a boiler.

BRAZED JOINT. A gas-tight joint obtained by the joining of metal parts with metallic mixtures or alloys which melt at a temperature above 1,000°F (538°C), but lower than the melting temperature of the parts to be joined.

BRAZING. A metal joining process wherein coalescence is produced by the use of a nonferrous filler metal having a melting point above 1,000°F (538°C), but lower than that of the base metal being joined. The filler material is distributed between the closely fitted surfaces of the joint by capillary attraction.

BTU. Abbreviation for British thermal unit, which is the quantity of heat required to raise the temperature of 1 pound (454 g) of water 1°F (0.56°C) (1 Btu = 1055 J).

BUILDING. Any structure occupied or intended for supporting or sheltering any occupancy.

CHIMNEY. A primarily vertical structure containing one or more flues, for the purpose of carrying gaseous products of combustion and air from a fuel-burning appliance to the outside atmosphere.

Factory-built chimney. A listed and labeled chimney composed of factory-made components, assembled in the field in accordance with manufacturer's instructions and the conditions of the listing.

Masonry chimney. A field-constructed chimney composed of solid masonry units, bricks, stones or concrete.

Metal chimney. A field-constructed chimney of metal.

CHIMNEY CONNECTOR. A pipe that connects a fuel-burning appliance to a chimney.

CLEARANCE. The minimum distance through air measured between the heat-producing surface of the mechanical appliance, device or equipment and the surface of the combustible material or assembly.

CLOSED COMBUSTION SOLID-FUEL-BURNING APPLIANCE. A heat-producing appliance that employs a combustion chamber that has no openings other than the flue collar, fuel charging door and adjustable openings provided to control the amount of combustion air that enters the combustion chamber.

CLOTHES DRYER. An appliance used to dry wet laundry by means of heat. Dryer classifications are as follows:

Type 1. Factory-built package, multiple production. Primarily used in family living environment. Usually the smallest unit physically and in function output.

Type 2. Factory-built package, multiple production. Used in business with direct intercourse of the function with the public. Not designed for use in individual family living environment.

CODE. These regulations, subsequent amendments thereto, or any emergency rule or regulation that the administrative authority having jurisdiction has lawfully adopted.

CODE OFFICIAL. The officer or other designated authority charged with the administration and enforcement of this code, or a duly authorized representative.

COMBUSTIBLE ASSEMBLY. Wall, floor, ceiling or other assembly constructed of one or more component materials that are not defined as noncombustible.

COMBUSTIBLE LIQUIDS. Any liquids having a flash point at or above 100°F (38°C), and that are divided into the following classifications:

Class II. Liquids having flash points at or above 100°F (38°C) and below 140°F (60°C).

Class IIIA. Liquids having flash points at or above 140°F (60°C) and below 200°F (93°C).

Class IIIB. Liquids having flash points at or above 200°F (93°C).

COMBUSTIBLE MATERIAL. Any material not defined as noncombustible.

COMBUSTION. In the context of this code, refers to the rapid oxidation of fuel accompanied by the production of heat or heat and light.

COMBUSTION AIR. Air necessary for complete combustion of a fuel, including theoretical air and excess air.

COMBUSTION CHAMBER. The portion of an appliance within which combustion occurs.

COMBUSTION PRODUCTS. Constituents resulting from the combustion of a fuel with the oxygen of the air, including the inert gases, but excluding excess air.

COMMERCIAL FOOD HEAT-PROCESSING APPLIANCES. Appliances used in a food-processing establishment for heat-processing food or utensils, and which produce grease vapors, steam, fumes, smoke or odors that are required to be removed through a local exhaust ventilation system. Such appliances include deep fat fryers; upright broilers; griddles; broilers; fry grills; steam-jacketed kettles; hot-top ranges; charbroilers; ovens; barbecues; rotisseries; and similar appliances. For the purpose of this definition, a food-processing establishment shall include any building or a portion thereof used for the processing of food.

COMPENSATING HOODS. Compensating hoods are those having integral (built-in) makeup air supply. The makeup air supply for such hoods is generally supplied from: short-circuit flow from inside the hood, air curtain flow from the bottom of the front face, and front face discharge from the outside front wall of the hood. The compensating makeup airflow can also be supplied from the rear or side of the hood, or the rear, front, or sides of the cooking equipment. The makeup airflow can be one or a combination of methods.

SUPPLY AIR SYSTEM. An assembly of connected ducts, plenums, fittings, registers and grilles through which air, heated or cooled, is conducted from the supply unit to the space or spaces to be heated or cooled (see also "Return air system").

THEORETICAL AIR. The exact amount of air required to supply oxygen for complete combustion of a given quantity of a specific fuel.

THERMAL RESISTANCE (*R*). A measure of the ability to retard the flow of heat. The *R*-value is the reciprocal of thermal conductance.

TLV-TWA (THRESHOLD LIMIT VALUE-TIME-WEIGHTED AVERAGE). The time-weighted average concentration of a refrigerant or other chemical in air for a normal 8-hour workday and a 40-hour workweek, to which nearly all workers are repeatedly exposed, day after day, without adverse effects, as adopted by the American Conference of Government Industrial Hygienists (ACGIH).

TOILET ROOM. A room containing a water closet and, frequently, a lavatory, but not a bathtub, shower, spa or similar bathing fixture.

TOXICITY CLASSIFICATION. Refrigerants shall be classified for toxicity to one of two classes in accordance with ASHRAE 34:

Class A. Refrigerants for which toxicity has not been identified at concentrations less than or equal to 400 parts per million (ppm), based on data used to determine Threshold Limit Value-Time-Weighted Average (TLV-TWA) or consistent indices.

Class B. Refrigerants for which there is evidence of toxicity at concentrations below 400 ppm, based on data used to determine TLV-TWA or consistent indices.

TRANSITION FITTINGS, PLASTIC TO STEEL. An adapter for joining plastic pipe to steel pipe. The purpose of this fitting is to provide a permanent, pressure-tight connection between two materials which cannot be joined directly one to another.

UNCONFINED SPACE. A space having a volume not less than 50 cubic feet per 1,000 Btu/h (4.8 m^3/kW) of the aggregate input rating of all appliances installed in that space. Rooms communicating directly with the space in which the appliances are installed, through openings not furnished with doors, are considered a part of the unconfined space.

UNIT HEATER. A self-contained appliance of the fan type, designed for the delivery of warm air directly into the space in which the appliance is located.

UNUSUALLY TIGHT CONSTRUCTION. See s. Comm 65.0201.

Note: Section Comm 65.0201 reads: " 'Unusually tight construction' means the total area of outdoor openings is less than 3 percent of the floor area of the space in which equipment is located." [Comm 64.0202 (2) (b)]

VENT. A pipe or other conduit composed of factory-made components, containing a passageway for conveying combustion products and air to the atmosphere, listed and labeled for use with a specific type or class of appliance.

Pellet vent. A vent listed and labeled for use with listed pellet fuel-burning appliances.

Type L vent. A vent listed and labeled for use with oil-burning appliances that are listed for use with Type L vents.

VENT CONNECTOR. The pipe that connects an approved fuel-fired appliance to a vent.

VENT DAMPER DEVICE, AUTOMATIC. A device intended for installation in the venting system, in the outlet of an individual automatically operated fuel-burning appliance that is designed to open the venting system automatically when the appliance is in operation and to close off the venting system automatically when the appliance is in a standby or shutdown condition.

VENTILATION. The natural or mechanical process of supplying conditioned or unconditioned air to, or removing such air from, any space.

VENTILATION AIR. That portion of supply air that comes from the outside (outdoors), plus any recirculated air that has been treated to maintain the desired quality of air within a designated space.

VENTING SYSTEM. A continuous open passageway from the flue collar of an appliance to the outside atmosphere for the purpose of removing flue or vent gases. A venting system is usually composed of a vent or a chimney and vent connector, if used, assembled to form the open passageway.

WATER HEATER. Any heating appliance or equipment that heats potable water and supplies such water to the potable hot water distribution system.

CHAPTER 3

GENERAL REGULATIONS

SECTION 301
GENERAL

301.1 Scope. This chapter shall govern the approval and installation of all equipment and appliances that comprise parts of the building mechanical systems regulated by this code in accordance with Section 101.2.

301.2 Energy utilization. Heating, ventilating and air-conditioning systems of all structures shall be designed and installed for efficient utilization of energy in accordance with the *International Energy Conservation Code*.

Comm 64.0301 (1) Note: See ch. Comm 63 for additional requirements.

301.3 Fuel gas appliances and equipment. The approval and installation of fuel gas distribution piping and equipment, fuel gas-fired appliances and fuel gas-fired appliance venting systems shall be in accordance with the *International Fuel Gas Code*.

301.4 [Comm 64.0301 (2)] Listed and labeled.

(a) General. All appliances regulated by ch. Comm 64 shall be listed and labeled as specified in ch. Comm 64, unless approved by the department in accordance with par. (b) or the product approval criteria in s. Comm 61.60.

(b) Unlisted equipment. The department may approve an installation of unlisted equipment after receipt of all of the following:

1. A statement from the equipment manufacturer indicating the national standard with which the equipment complies.
2. The results of a test conducted by a Wisconsin registered engineer on the output and safety controls in accordance with the national standard used by the manufacturer.

301.5 Labeling. Labeling shall be in accordance with the procedures set forth in Sections 301.5.1 through 301.5.2.3.

301.5.1 Testing. An approved agency shall test a representative sample of the mechanical equipment and appliances being labeled to the relevant standard or standards. The approved agency shall maintain a record of all of the tests performed. The record shall provide sufficient detail to verify compliance with the test standard.

301.5.2 Inspection and identification. The approved agency shall periodically perform an inspection, which shall be in-plant if necessary, of the mechanical equipment and appliances to be labeled. The inspection shall verify that the labeled mechanical equipment and appliances are representative of the mechanical equipment and appliances tested.

301.5.2.1 Independent. The agency to be approved shall be objective and competent. To confirm its objectivity, the agency shall disclose all possible conflicts of interest.

301.5.2.2 Equipment. An approved agency shall have adequate equipment to perform all required tests. The equipment shall be periodically calibrated.

301.5.2.3 Personnel. An approved agency shall employ experienced personnel educated in conducting, supervising and evaluating tests.

301.6 Label information. A permanent factory-applied nameplate(s) shall be affixed to appliances on which shall appear in legible lettering, the manufacturer's name or trademark, the model number, serial number and the seal or mark of the approved agency. A label shall also include the following:

1. Electrical equipment and appliances: Electrical rating in volts, amperes and motor phase; identification of individual electrical components in volts, amperes or watts, motor phase; Btu/h (W) output; and required clearances.
2. Absorption units: Hourly rating in Btu/h (W); minimum hourly rating for units having step or automatic modulating controls; type of fuel; type of refrigerant; cooling capacity in Btu/h (W); and required clearances.
3. Fuel-burning units: Hourly rating in Btu/h (W); type of fuel approved for use with the appliance; and required clearances.
4. Electric comfort heating appliances: Name and trademark of the manufacturer; the model number or equivalent; the electric rating in volts, ampacity and phase; Btu/h (W) output rating; individual marking for each electrical component in amperes or watts, volts and phase; required clearances from combustibles; and a seal indicating approval of the appliance by an approved agency.

301.7 [Comm 64.0301 (3)] Electrical. Electrical wiring, controls and connections to equipment and appliances regulated by this code shall be in accordance with ch. Comm 16.

301.8 [Comm 64.0301 (4)] Plumbing connections. Potable water supply and building drainage system connections to equipment and appliances regulated by this code shall be in accordance with chs. Comm 81-87.

301.9 Fuel types. Fuel-fired appliances shall be designed for use with the type of fuel to which they will be connected and the altitude at which they are installed. Appliances that comprise parts of the building mechanical system shall not be converted for the usage of a different fuel, except where approved and converted in accordance with the manufacturer's instructions. The fuel input rate shall not be increased or decreased beyond

the limit rating for the altitude at which the appliance is installed.

301.10 Vibration isolation. Where vibration isolation of equipment and appliances is employed, an approved means of supplemental restraint shall be used to accomplish the support and restraint.

301.11 Repair. Defective material or parts shall be replaced or repaired in such a manner so as to preserve the original approval or listing.

301.12 Wind resistance. Mechanical equipment, appliances and supports that are exposed to wind shall be designed and installed to resist the wind pressures determined in accordance with the *International Building Code*.

[B] 301.13 Flood hazard. For structures located in a special flood-hazard area, mechanical systems shall comply with the flood-resistant construction requirements of the *International Building Code*.

301.14 Prohibited location. Mechanical systems shall not be located in an elevator shaft.

301.15 Rodent proofing. Buildings or structures and the walls enclosing habitable or occupiable rooms and spaces in which persons live, sleep or work, or in which feed, food or foodstuffs are stored, prepared, processed, served or sold, shall be constructed to protect against the entrance of rodents in accordance with the *International Building Code*.

301.16 Seismic resistance. When earthquake loads are applicable in accordance with the *International Building Code*, mechanical system supports shall be designed and installed for the seismic forces in accordance with the *International Building Code*.

SECTION 302
PROTECTION OF STRUCTURE

302.1 Structural safety. The building or structure shall not be weakened by the installation of mechanical systems. Where floors, walls, ceilings or any other portion of the building or structure are required to be altered or replaced in the process of installing or repairing any system, the building or structure shall be left in a safe structural condition in accordance with the *International Building Code*.

302.2 Penetrations of floor/ceiling assemblies and fire-resistance-rated assemblies. Penetrations of floor/ceiling assemblies and assemblies required to have a fire-resistance rating shall be protected in accordance with the *International Building Code*.

[B] 302.3 Cutting, notching and boring in wood framing. The cutting, notching and boring of wood framing members shall comply with Sections 302.3.1 through 302.3.3.

[B] 302.3.1 Joist notching. Notches on the ends of joists shall not exceed one-fourth the joist depth. Holes bored in joists shall not be within 2 inches (51 mm) of the top or bottom of the joist, and the diameter of any such hole shall not exceed one-third the depth of the joist. Notches in the top or bottom of joists shall not exceed one-sixth the depth and shall not be located in the middle third of the span.

[B] 302.3.2 Stud cutting and notching. In exterior walls and bearing partitions, any wood stud is permitted to be cut or notched not to exceed 25 percent of its depth. Cutting or notching of studs not greater than 40 percent of their depth is permitted in nonbearing partitions supporting no loads other than the weight of the partition.

[B] 302.3.3 Bored holes. A hole not greater in diameter than 40 percent of the stud depth is permitted to be bored in any wood stud. Bored holes not greater than 60 percent of the depth of the stud are permitted in nonbearing partitions or in any wall where each bored stud is doubled, provided not more than two such successive doubled studs are so bored. In no case shall the edge of the bored hole be nearer than 0.625 inch (15.9 mm) to the edge of the stud. Bored holes shall not be located at the same section of stud as a cut or notch.

[B] 302.4 Cutting, notching and boring in steel framing. The cutting, notching and boring of steel framing members shall comply with Sections 302.4.1 through 302.4.3.

[B] 302.4.1 Cutting, notching and boring holes in structural steel framing. The cutting, notching and boring of holes in structural steel framing members shall be as prescribed by the registered design professional.

[B] 302.4.2 Cutting, notching and boring holes in cold-formed steel framing. Flanges and lips of load-bearing cold-formed steel framing members shall not be cut or notched. Holes in webs of load-bearing cold-formed steel framing members shall be permitted along the centerline of the web of the framing member and shall not exceed the dimensional limitations, penetration spacing or minimum hole edge distance as prescribed by the registered design professional. Cutting, notching and boring holes of steel floor/roof decking shall be as prescribed by the registered design professional.

[B] 302.4.3 Cutting, notching and boring holes in nonstructural cold-formed steel wall framing. Flanges and lips of nonstructural cold-formed steel wall studs shall not be cut or notched. Holes in webs of nonstructural cold-formed steel wall studs shall be permitted along the centerline of the web of the framing member, shall not exceed 1.5 inches (38 mm) in width or 4 inches (102 mm) in length, and shall not be spaced less than 24 inches (610 mm) center to center from another hole or less than 10 inches (254 mm) from the bearing end.

SECTION 303
EQUIPMENT AND APPLIANCE LOCATION

303.1 General. Equipment and appliances shall be located as required by this section, specific requirements elsewhere in this code and the conditions of the equipment and appliance listing.

TABLE 308.6
CLEARANCE REDUCTION METHODS

TYPE OF PROTECTIVE ASSEMBLY[a]	REDUCED CLEARANCE WITH PROTECTION (inches)[a]							
	Horizontal combustible assemblies located above the heat source				Horizontal combustible assemblies located beneath the heat source and all vertical combustible assemblies			
	Required clearance to combustibles without protection (inches)[a]				Required clearance to combustibles without protection (inches)[a]			
	36	18	9	6	36	18	9	6
Galvanized sheet metal, minimum nominal thickness of 0.024 inch (No. 24 Gage), mounted on 1-inch glass fiber or mineral wool batt reinforced with wire on the back, 1 inch off the combustible assembly	18	9	5	3	12	6	3	3
Galvanized sheet metal, minimum nominal thickness of 0.024 inch (No. 24 Gage), spaced 1 inch off the combustible assembly	18	9	5	3	12	6	3	2
Two layers of galvanized sheet metal, minimum nominal thickness of 0.024 inch (No. 24 Gage), having a 1-inch airspace between layers, spaced 1 inch off the combustible assembly	18	9	5	3	12	6	3	3
Two layers of galvanized sheet metal, minimum nominal thickness of 0.024 inch (No. 24 Gage), having 1 inch of fiberglass insulation between layers, spaced 1 inch off the combustible assembly	18	9	5	3	12	6	3	3
0.5-inch inorganic insulating board, over 1 inch of fiberglass or mineral wool batt, against the combustible assembly	24	12	6	4	18	9	5	3
3.5-inch brick wall, spaced 1 inch off the combustible wall	—	—	—	—	12	6	6	6
3.5-inch brick wall, against the combustible wall	—	—	—	—	24	12	6	5

For SI: 1 inch = 25.4 mm, °C = [(°F)-32]/1.8, 1 pound per cubic foot = 16.02 kg/m^3, 1.0 Btu × in/ft^2 · h · °F = 0.144 W/m^2 · °K.

a. Mineral wool and glass fiber batts (blanket or board) shall have a minimum density of 8 pounds per cubic foot and a minimum melting point of 1,500°F. Insulation material utilized as part of a clearance reduction system shall have a thermal conductivity of 1.0 Btu × in/(ft^2 · h · °F) or less. Insulation board shall be formed of noncombustible material.

308.9 Chimney connector pass-throughs. The clearance reduction methods specified in Table 308.6 shall not be utilized to reduce the clearances required for chimney connector pass-throughs as specified in Section 803.10.4.

308.10 Masonry fireplaces. The clearance reduction methods specified in Table 308.6 shall not be utilized to reduce the clearances required for masonry fireplaces as specified in Chapter 8 and the *International Building Code*.

308.11 Kitchen exhaust ducts. The clearance reduction methods specified in Table 308.6 shall not be utilized to reduce the minimum clearances required by Section 506.3.11 for kitchen exhaust ducts enclosed in a shaft.

[B] SECTION 309
TEMPERATURE CONTROL

309.1 [Comm 64.0309]

(1) Heating system design. Except as provided in subs. (2) or (3), the heating system shall be designed and operated to maintain a temperature of not less than that shown in Table 64.0403 at 3 feet (914 mm) above the floor within the occupied space during occupied periods.

(2) Spot heating. Spot heating may be used to heat individual fixed work stations in industrial buildings in lieu of heating the entire space as specified in sub. (1), provided the inside design temperature at the fixed work station is at least 60°F (16 °C).

(3) Seasonal occupancies. When approved by the department, heating requirements may be waived, but not ventilation required by this code, during the period of May 15 through September 15 for the following or similar occupancies: drive-in eating places, club houses, outdoor toilets, camp lodge buildings, canning factories and migrant labor camps.

[F] SECTION 310
EXPLOSION VENTING

310.1 Required. Structures occupied for purposes involving explosion hazards shall be provided with explosion control where required by the *International Fire Code*. Explosion control systems shall be designed and installed in accordance with the *International Fire Code*.

[F] SECTION 311
SMOKE AND HEAT VENTS

311.1 Required. Approved smoke and heat vents shall be installed in the roofs of one-story buildings where required by the fire prevention code. Smoke and heat vents shall be designed and installed in accordance with the *International Fire Code*.

SECTION 312
HEATING AND COOLING LOAD CALCULATIONS

312.1 Load calculations. Heating and cooling system design loads for the purpose of sizing systems, appliances and equipment shall be determined in accordance with the procedures described in the ASHRAE *Handbook of Fundamentals* or an equivalent computation procedure, using the design parameters specified in Chapter 3 of the *International Energy Conservation Code*.

Comm 64.0312 Note: For design parameters in the IECC, refer to ch. Comm 63 or IECC Section 803.

Comm 64.0313 Other requirements.

(1) Balancing, final test required. Every heating, ventilating and air-conditioning system shall be balanced upon installation. The person or agency responsible for balancing of the ventilating system shall document in writing the amount of outdoor air being provided and distributed for the building occupants and any other specialty ventilation. The document shall be retained at the site and shall be made available to the department upon request.

(a) Air systems shall be balanced in a manner to minimize losses from damper throttling by first adjusting fan speed then adjusting dampers to meet design flow conditions. Balancing procedures shall be acceptable to the department. Damper throttling alone may be used for air system balancing with fan motors of 1 hp or less, or if throttling results in no greater than 1/3 hp fan horsepower draw above that required if the fan speed were adjusted.

(b) Either of the following test methods shall be used:

1. Hydronic systems shall be balanced in a manner to minimize valve throttling losses by first trimming the pump impeller or adjusting the pump speed then adjusting the valves to meet design flow conditions.
2. Valve throttling alone may be used for hydronic system balancing under any of the following conditions as specified in subds. 2.a. to d.
   a. Pumps with pump motors of 10 hp or less.
   b. If throttling results in no greater than 3 hp pump horsepower draw for pumps of 60 hp or less, or no greater than 5% of pump horsepower draw for pumps greater than 60 hp, above that required if the impeller were trimmed.
   c. To reserve additional pump pressure capability in open circuit piping systems subject to fouling. Valve throttling pressure drop shall not exceed that expected for future fouling.
   d. Where it can be shown that throttling will not increase overall building energy costs.

Note: National Environmental Balancing Bureau (NEBB) Procedural Standards, the Associated Air Balance Council (AABC) National Standards, the Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA), or equivalent balancing procedures are acceptable to the department.

(2) Balancing, proper working condition. HVAC control systems shall be tested to assure that control elements are calibrated, adjusted and in proper working condition.

(3) Balancing, operating and maintenance manual. An operating and maintenance manual shall be provided to the building owner or operator. The manual shall include basic data relating to the operation and maintenance of HVAC systems and equipment. Required routine maintenance actions shall be clearly identified. Where applicable, HVAC controls information such as diagrams, schematics, control sequence descriptions, and maintenance and calibration information shall be included.

CHAPTER 4

VENTILATION

SECTION 401
GENERAL

401.1 Scope. This chapter shall govern the ventilation of spaces within a building intended to be occupied. This chapter does not govern the requirements for smoke control systems.

401.2 [Comm 64.0401 (1)] Ventilation required. Every occupied space shall be ventilated by natural means in accordance with IMC Section 402 or by mechanical means in accordance with IMC Section 403 and as specified in Table 64.0403.

401.3 [Comm 64.0401 (2)] When required.

(a) Outside air. Mechanical ventilation systems shall be operated to provide a continuous source of outside air to all areas while people are present.

(b) Operation.

1. Except as provided in subd. 2., the required building exhaust ventilating systems shall operate continuously when people are in the building to provide the amount of exhaust specified in Table 64.0403.

Note: Chapter Comm 32 may require continuous operation of some exhaust systems, such as purging systems, chloride storage exhaust or industrial exhaust.

2. Subdivision 1. does not apply to all of the following:
   a. Toilet rooms with two or fewer total water closets or urinals, if the required ventilation is provided when the room is occupied.
   b. Shower rooms with two or fewer showerheads if the required ventilation is provided when the room is occupied.
   c. Common residential laundry rooms with a total of four or fewer washers and dryers if the required ventilation is provided when the room is occupied.
   d. Mechanical exhaust systems for natatoriums even when the building is not occupied.

[B] 401.4 [Comm 64.0401 (3)] Exits. Vestibule ventilation for smokeproof enclosures shall be in accordance with the IBC.

401.5 Opening location. Outside air exhaust and intake openings shall be located a minimum of 10 feet (3048 mm) from lot lines or buildings on the same lot. Where openings front on a street or public way, the distance shall be measured to the centerline of the street or public way.

Exception: Group R-3.

Comm 64.0401 (4)

(a) Additional requirements.

1. Mechanical and required gravity outside air intake openings shall be located a minimum of 10 feet (3048 mm) from any hazardous or noxious contaminant such as vents, chimneys, plumbing vents, streets, alleys, parking lots and locating docks, except as otherwise specified in this code. Where a source of contaminant is located within 10 feet (3048 mm) of an intake opening, such opening shall be located a minimum of 2 feet (610 mm) below the contaminant source.
2. The lowest side of outside air intake required openings shall be located at least 12 inches (305 mm) vertically from the adjoining grade level, above adjoining roof surfaces, or above the bottom of an areaway.
3. If an outside air intake is located in an areaway, the areaway shall have a horizontal cross section equal to or greater than the free area of the outside air intake opening.
4. For health care facilities, all of the following shall apply:
   a. Except as provided under subpar. b., outdoor air intakes shall be located at least 25 feet (7620 mm) from exhaust outlets of ventilating systems, combustion equipment stacks, medical-surgical vacuum systems, plumbing vents or areas that may collect vehicular exhaust or other noxious fumes.
   b. Plumbing and vacuum vents that terminate at a level above the top of the air intake may be located as close as 10 feet (3048 mm) to an outdoor air intake.
   c. The bottom of outdoor air intakes serving central systems shall be located at least 6 feet (1829 mm) above ground level or, when installed above the roof, at least 3 feet (914 mm) above roof level.
   d. Exhaust outlets from areas that may be contaminated shall be located above roof level and arranged to minimize recirculation of exhaust air into the building.

(b) Exceptions:

1. The setback distances as specified in IMC Section 401.5.1 shall not apply to the combustion air intake of a direct vent appliance.
2. Unless a greater distance is specified by the manufacturer, exhaust openings for 100 cfm or less discharge shall be located at least 12 inches (305 mm), measured in any direction, from doors or openable windows.
3. The 10-foot (3048 mm) minimum separation does not apply to the intake and exhaust of a factory-packaged rooftop unit or other listed outdoor appliance provided nothing restricts air flow around the unit. The exhaust and intake of the unit shall be located to minimize contamination of outside air.

4. Unless a greater distance is specified by the manufacturer, product of combustion outlets of direct vent appliance vents shall terminate at least 12 inches (305 mm) measured in any direction from doors or openable windows.
5. Where it can be demonstrated that an engineered system design will prevent the maximum concentration of contaminants brought in through the outside air intake from exceeding the maximum contaminant concentration obtainable by providing the separation distances in accordance with sub. (4) (a), the outdoor air intakes may be located in accordance with such engineered system design.

Note: See ch. Comm 82 for plumbing vent setbacks. That rule requires plumbing vents to be 10 feet (3048 mm) from air intakes and 10 feet (3048 mm) horizontally from or 2 feet (610 mm) above roof scuttles, doors or openable windows.

Note: See NFPA standard 45, Fire Protection for Laboratories Using Chemicals, adopted under ch. Comm 10, for chemical fume hood exhaust location. Health care and related facilities may have additional requirements.

401.5.2 Exhaust openings. Outside exhaust openings shall be located so as not to create a nuisance. Exhaust air shall not be directed onto walkways.

Comm 64.0401 (5)

(a) Gravity ventilation ducts. Gravity ventilation ducts shall extend not less than 2 feet (610 mm) above the highest portion of the building within a 10-foot (3048 mm) radius of the duct and shall be provided with a siphon roof ventilator.

(b) Barometric relief vents. Where barometric relief vents are installed on the roof, the discharge openings shall be no less than 2 feet (610 mm) above the roof surface where the vent pierces the roof.

401.6 Outdoor opening protection. Air exhaust and intake openings that terminate outdoors shall be protected with corrosion-resistant screens, louvers or grilles. Openings in louvers, grilles and screens shall be sized in accordance with Table 401.6, and shall be protected against local weather conditions. Outdoor air exhaust and intake openings located in exterior walls shall meet the provisions for exterior wall opening protectives in accordance with the *International Building Code*.

TABLE 401.6
OPENING SIZES IN LOUVERS, GRILLES AND SCREENS PROTECTING OUTDOOR EXHAUST AND AIR INTAKE OPENINGS

OUTDOOR OPENING TYPE	MINIMUM AND MAXIMUM OPENING SIZES IN LOUVERS, GRILLES AND SCREENS MEASURED IN ANY DIRECTION
Exhaust openings	Not < $^1/_4$ inch and not > $^1/_2$ inch
Intake openings in residential occupancies	Not < $^1/_4$ inch and not > $^1/_2$ inch
Intake openings in other than residential occupancies	> $^1/_4$ inch and not > 1 inch

For SI: 1 inch = 25.4 mm.

401.7 Contaminant sources. Stationary local sources producing air-borne particulates, heat, odors, fumes, spray, vapors, smoke or gases in such quantities as to be irritating or injurious to health shall be provided with an exhaust system in accordance with Chapter 5 or a means of collection and removal of the contaminants. Such exhaust shall discharge directly to an approved location at the exterior of the building.

[B] SECTION 402
NATURAL VENTILATION

402.1 General. Natural ventilation of an occupied space shall comply with Chapter 12 of the *International Building Code*.

Comm 64.0402 Natural ventilation shall be permitted only in areas specified in Table 64.0403.

SECTION 403
MECHANICAL VENTILATION

403.1 [Comm 64.0403 (1)] Ventilation system.

(a) Mechanical ventilation shall be provided by a method of supply air and exhaust air. The amount of supply air shall be approximately equal to the amount of return and exhaust air. The system shall not be prohibited from producing negative or positive pressure. The system to convey ventilation air shall be designed and installed in accordance with IMC Chapter 6.

(b) Ventilation supply systems shall be designed to deliver the required rate of supply air into the occupied zone within an occupied space.

403.2 Outdoor air required. The minimum ventilation rate of required outdoor air shall be determined in accordance with Section 403.3.

Comm 64.0403 (2)

(a) Exception: Where it can be demonstrated that an engineered ventilation system design will prevent the maximum concentration of contaminants from exceeding the maximum obtainable by providing the rate of outdoor air ventilation determined in accordance with IMC Section 403.3, the minimum required rate of outdoor air may be reduced in accordance with such engineered system design.

(b) Additional requirement. The outdoor air shall be free from contamination of any kind in proportions detrimental to the health and comfort of the general population exposed to it.

403.2.1 [Comm 64.0403 (3)] Recirculation of air. The air required by Section 403.3 shall not be recirculated. Air in excess of that required by Section 403.3 shall not be prohibited from being recirculated as a component of supply air to building spaces, except that:

1. Ventilation air shall not be recirculated from one dwelling to another or to dissimilar occupancies.
2. Supply air to a swimming pool and associated deck areas shall not be recirculated unless such air is dehumidified to maintain the relative humidity of the area at 60 percent or less. Air from this area shall not be recirculated to other spaces.
3. Where mechanical exhaust is required by Table 64.0403, recirculation of air from such spaces shall be

prohibited. All air supplied to such spaces shall be exhausted, including any air in excess of that required by Table 64.0403.

Comm 64.0403 (4) (a) Air supply in hospitals and ambulatory surgery centers.

1. In hospitals and ambulatory surgery centers, air supply for operating rooms and delivery rooms that are designed for cesarean sections shall be provided from ceiling outlets located near the center of the work area. Return-air inlets shall be located near the floor level. Each operating room and delivery room designed for cesarean-section deliveries shall have at least two return-air inlets located as remotely from each other as practical.
2. In hospitals and ambulatory surgery centers, air supply outlets for rooms used for invasive procedures shall be located at or near the ceiling. Return or exhaust air inlets shall be located near the floor level. Exhaust grills for anesthesia evacuation and other special applications may be installed in the ceiling.

Comm 64.0403 (4) (b) Note: The following are examples where the department will accept air transferred from: corridor to toilet room; corridor to cloak room or janitor closet; dining room to kitchen; locker room to toilet room; gymnasium to locker room; showroom to garage; and corridor to school vocational shops.

403.2.2 [Comm 64.0403 (5)] Transfer air. Except where recirculation from such spaces is prohibited by Table 64.0403, air transferred from occupied spaces is not prohibited from serving as makeup air for required exhaust systems in such spaces as kitchens, baths, toilet rooms, elevators and smoking lounges. The amount of transfer air and exhaust air shall be sufficient to provide the flow rates as specified in Sections 403.3 and 403.3.1. The required outdoor air rates specified in Table 64.0403 shall be introduced directly into such spaces or into the occupied spaces from which air is transferred or a combination of both.

403.3 [Comm 64.0403 (6)] Ventilation rate.

(a) Ventilation rate determination.

1. Except as provided in pars. (c) and (d), ventilation systems shall be designed to have the capacity to supply the minimum outdoor airflow rate determined in accordance with Table 64.0403 based on the occupancy of the space, the occupant load and a minimum of 7.5 cfm of outside air per person, or other parameters stated in Table 64.0403.
2. a. Except as provided in subpars. b. to d., the occupant load utilized for design of the ventilation system shall not be less than the number determined from the estimated maximum occupant load rate indicated in Table 64.0403.

   b. The estimated maximum occupant load rate may be determined using other means with justification acceptable to the department to show that a different number of occupants is reasonable.

   c. Where there is no value indicated for the net square feet per person in Table 64.0403, the actual number of occupants shall be used to determine the required amount of outside air.

   d. Ventilation rates for occupancies not represented in Table 64.0403 shall be determined by an approved engineering analysis, or by using the most similar occupancy in the table.
3. The ventilation system shall be designed to supply the required rate of ventilation air continuously during the period the building is occupied, except as otherwise stated in other provisions of this chapter.

Note: See Table 64.0403 for specific occupancies.

(b) Adjacent spaces with differing ventilation requirements.

1. Except as provided in subd. 2., spaces with different ventilation requirements shall be provided with a complete solid separation, or the most stringent ventilation requirement shall apply to all unseparated areas.
2. The separation as specified in subd. 1. is not required where an engineered ventilation design system will prevent the concentration of contaminants from exceeding that obtainable by providing a physical separation.

(c) Exceptions for certain occupancies.

1. **Toilet rooms.** A toilet room that has only one water closet or urinal and no bathtub or shower may be provided with either natural ventilation via a window or louvered opening with at least 2 square feet (0.2 m^2) of area openable directly to the outside or mechanical exhaust ventilation as specified in Table 64.0403.
2. **Janitor closets.** A janitor closet that has only one service sink may be provided with either natural ventilation via a window or louvered opening with at least 2 square feet (0.2 m^2) of area openable directly to the outside or mechanical exhaust ventilation as specified in Table 64.0403.
3. **Locker and shower rooms.** An adjoining locker room, shower room and toilet room shall be exhausted at the rate specified in Table 64.0403 based on the largest amount of exhaust required for any of the three rooms. A negative pressure relationship shall be maintained in the shower and toilet rooms with respect to the locker room.
4. **Chemical or septic toilets.** Chemical or septic toilets and composting privies are prohibited in spaces under negative pressure. Toilet rooms with chemical or septic toilets shall be provided with natural ventilation via a window, louver or skylight with at least 2 square feet (0.2 m^2) of area openable directly to the outside. The opening shall be provided with a screen to limit the passage of insects and vermin.
5. **Pool ventilation.** In a natatorium, the volume of supply air and exhaust air may be reduced to a minimum of 1 cfm per square foot [0.00508$m^3/(s \cdot m^2)$] of pool surface provided automatic humidity controls perform so as not to create accelerated building material deterioration from moisture condensation.

TABLE 64.0403
REQUIRED MINIMUM INSIDE TEMPERATURE AND OUTDOOR VENTILATION AIR

OCCUPANCY CLASSIFICATION[i]	VENTILATION REQUIREMENTS BASIS OF CAPACITY				
	Minimum Inside Temperature (degrees F)	Estimated Maximum Occupant Load (persons per 1,000 sq. ft.)[a]	Natural Ventilation Allowed	Exhaust[e] (cfm/net sq. ft. floor area)	Air Change Rate[k] (minimum air change per hour with A/C)
Correctional facilities					
Sleeping rooms[j]	68	20	yes	—	—
Dining halls	68	100	no	—	2.0
Guard stations	68	40	yes	—	—
Dry cleaners, laundries					
Coin-operated dry cleaners	68	8	yes	—	1.0
Coin-operated laundries	68	8	yes	—	1.0
Commercial dry cleaner	60	—	no	2.00	—
Commercial laundries	60	—	no	2.00	—
Storage, pick up	60	8	yes	—	1.0
Apartment laundry rooms	60	—	no	0.5	—
Education					
Auditoriums	68	150	no	—	2.0
Classrooms	68	50	no	—	2.0
Day care facilities	68	30	yes only if < 20 children	—	2.0
Laboratories (science)	68	30	no	—	2.0
Corridors with lockers	68	—	—	—	10 cfm/lineal ft. of length
Music rooms	68	50	no	—	2.0
Smoking lounges[b,g]	68	—	no	2.00	—
Special education	68	35	no	—	2.0
Training shops	60	30	no	—	—
Food and beverage service					
Bars and cocktail lounges	68	100	no	—	2.0
Cafeterias, fast food	68	100	no	—	2.0
Dining rooms	68	70	no	—	2.0
Kitchens (cooking)[f,g]	60	20	yes	—	1.0
Health care facilities Hospitals Nursing homes Ambulatory surgery centers	footnote m	footnote m	no	footnote m	footnote m
Hotels, motels, resorts and dorms					
Assembly rooms	68	120	no	—	2.0
Bathrooms[b,g]	68	—	no	35 cfm/room	—
Bedrooms	68	footnote n	yes	—	—
Conference rooms	68	50	no	—	2.0
Dormitory sleeping areas	68	20	yes	—	—
Casinos	68	—	no	2.00	—
Living rooms	68	footnote n	yes	—	—
Lobbies	68	30	no	—	—
Industrial/Factory					
Factories and machine shops	60	13	yes	—	—
Foundries	NMR	13	yes	—	—
Sawmill	NMR	—	yes	—	—
Offices					
Conference rooms	68	50	no	—	1.5
Office spaces	68	7	no	—	1.5
Reception areas	68	60	no	—	1.5
Telecommunication centers and data entry	68	60	no	—	1.5
Places of worship, entertainment and recreation which accomodate less than 100 persons	footnote h	—	yes	footnote h	—
Private dwellings, single and multiple					
Living areas	68	2 people for first bedroom plus one person for each additional bedroom	yes	—	—
Kitchens[g]	68	—	yes	100 cfm intermittent or 20 cfm continuous	—
Toilet rooms and bathrooms[g,l]	68	—	no	Mechanical exhaust capacity 50 cfm intermittent or 20 cfm continuous	—
Garages, separated by a solid wall for each dwelling	NMR	—	yes	100 cfm/vehicle	—
Garages, common for multiple units[b]	NMR	—	no	0.5	—

(continued)

TABLE 64.0403—continued
REQUIRED MINIMUM INSIDE TEMPERATURE AND OUTDOOR VENTILATION AIR

OCCUPANCY CLASSIFICATION[i]	VENTILATION REQUIREMENTS BASIS OF CAPACITY				
	Minimum Inside Temperature (degrees F)	Estimated Maximum Occupant Load (persons per 1,000 sq. ft.)[a]	Natural Ventilation Allowed	Exhaust[e] (cfm/net sq. ft. floor area)	Air Change Rate[k] (minimum air change per hour with A/C)
Retail stores, sales floors and showroom floors	68	8	yes	—	1.0
Seasonal occupancies, camps and lodges					
Dining and recreational areas	NMR	15	yes	—	—
Living and sleeping areas	NMR	—	yes	—	—
Club houses	NMR	15	yes	—	—
Drive-ins	NMR	15	yes	—	—
Specialty shops					
Automotive service and repair garages	60	—	no	0.5	—
Barber shop	68	25	no	—	—
Beauty salons[c]	68	—	no	0.5	—
Clothier, furniture specialty shops	68	8	yes	—	1.0
Florist shops	68	8	yes	—	1.0
Hardware, drugs, fabrics stores	68	8	yes	—	1.0
Supermarkets	68	8	yes	—	1.0
Sports and amusement					
Ballrooms and discos	68	100	no	—	2.0
Bleacher areas	68	363 or 18 in./person	no	—	2.0
Bowling centers (seating areas)	68	70	no	—	2.0
Game rooms	68	70	no	—	2.0
Natatoriums	76	—	—	2.0 cfm/sq. ft. pool area	—
Ice skating rinks (indoor)	NMR	5	no	—	—
Playing floor (gymnasiums)	68	30	no	—	2.0
Roller skating rinks (indoor)	60	30	no	—	2.0
Spectator areas (non-bleacher)	68	150	no	—	2.0
Storage					
Chlorine storage and handling rooms	NMR	—	no	2.00	—
Enclosed parking garages[d]	NMR	—	no	0.50	—
Warehouses	NMR	—	—	—	—
Theaters					
Auditoriums	68	150	no	—	2.0
Lobbies	68	150	no	—	—
Stages, studios	68	70	no	—	2.0
Ticket booths	68	60	no	—	2.0
Transportation					
Platforms	NMR	100	no	—	2.0
Waiting rooms	68	100	no	—	2.0
Utility and public spaces					
Elevators[g]	NMR	—	no	1.00	—
Janitor closets[l]	NMR	—	no	2.0 or 75 cfm/sink	—
Locker and dressing rooms[b]	70	—	no	0.5	—
Shower rooms	70	—	no	2.00	—
Toilet rooms[b, g, l]	68	—	no	75 cfm/TF	—
Smoking lounges[b, g]	68	—	no	2.0	—
Workrooms					
Bank vault	68	5	no	—	—
Meat processing workroom	NMR	10	yes	—	—
Pharmacy	68	20	yes	—	1.5
Photo studio	68	10	yes	—	1.0
Printing	60	13	yes	footnote o	—

For SI: 1 inch = 25.4 mm, 1 cubic foot per minute per square foot = 0.00508 $m^3/(s \cdot m^2)$, °C = [(°F) - 32]/1.8.

CFM = Cubic feet per minute; LF = Lineal foot; NMR = No minimum requirement; TF = Toilet fixtures (water closets and urinals); A/C =Air conditioning.

a. Based upon net floor area.

b. Mechanical exhaust is required and the recirculation of air from these spaces that would otherwise be allowed by IMC Section 403.2.1 is prohibited.

c. The classification of a "beauty" shop depends on the types of services provided. Only beauty salons routinely provide chemical processing of hair to produce texture or color changes, or manicures or other services with a similar need for air-borne contaminant and odor control.

d. Enclosed parking garages are parking garages with less than 30% open areas in the total wall area enclosing the garage. Ventilation systems in enclosed parking garages shall comply with IMC Section 404. A mechanical ventilation system shall not be required in garages having a floor area of 850 square feet or less and used for the storage of 5 or fewer motorized vehicles. Requirements for parking garages shall apply to all buildings, or parts of buildings, into which motor vehicles are driven for loading or unloading or are stored.

e. The ventilation rate is based upon cubic feet per minute per square foot of the floor area being ventilated.

f. The sum of the outdoor and transfer air from adjacent spaces shall be sufficient to provide an exhaust rate of not less than 1.5 cfm/sf.

g. Transfer air permitted in accordance with IMC Section 403.2.2.

h. See specific occupancy classification table entries for inside design temperature and cfm per net square feet floor area requirements.

i. This table is intended as a reference guide with generic Use types listed under those Occupancy types most often associated with the use. When Use types are mixed between Occupancy types and the Use type is unlisted within the specific Occupancy type, the use shall be ventilated as required by the same Use type listed in the other Occupancy type. Unlisted occupancies or uses shall be ventilated as required for the most similar listed occupancy classification acceptable to the department. Rooms that are used for different purposes at different times shall be designed for the greatest amount of ventilation required for any of the uses.

j. When unseparated toilet fixtures are included in sleeping areas (such as cells), the room shall be ventilated as required for toilet rooms.

k. See sub. (5) for specific requirements and exceptions. Units listed as minimum air change per hour with air conditioning unless otherwise specified.

l. Natural ventilation may be allowed under this section.

m. For air ventilation requirements in healthcare facilities, use American Institute of Architects (AIA) guidelines (AIA Guidelines for Design and Construction of Hospital and Health Care Facilities).

n. The minimum mechanical ventilation rate is 15 cfm/room of outside air.

o. Refer to IMC Chapter 5 for requirements.

6. **Health care facilities.** Recirculation and flow of air in health care facilities shall comply with the requirements in Table 2 or Table 6, as applicable, of AIA Guidelines for Design and Construction of Hospital and Health Care Facilities.

(d) Outside air requirement waived.

1. If a mechanical air supply system is provided and the requirement for outdoor air determined in accordance with Table 64.0403 is less than 5 percent of the minimum required air changes per hour, the requirement for outside air may be eliminated.

2. The requirement for outside air or percent of openings specified in Table 64.0403 may be omitted in large volume spaces containing 5,000 or more cubic feet (142 m^3) per occupant. Required exhaust ventilation and makeup air shall not be omitted.

403.3.1 [Comm 64.0403 (7)] System operation. The minimum flow rate of outdoor air that the ventilation system must be capable of supplying during its operation shall be permitted to be based on the rate per person indicated in Table 64.0403 and the actual number of occupants present.

403.3.2 Common ventilation system. Where spaces having different ventilation rate requirements are served by a common ventilation system, the ratio of outdoor air to total supply air for the system shall be determined based on the space having the largest outdoor air requirement or shall be determined in accordance with the following formula:

$$Y = \frac{X}{(1 + X - Z)} \qquad \textbf{(Equation 4-1)}$$

where:

$Y = V_{ot}/V_{st}$ = Corrected fraction of outdoor air in system supply.

$X = V_{on}/V_{st}$ = Uncorrected fraction of outdoor air in system supply.

$Z = V_{oc}/V_{sc}$ = Fraction of outdoor air in critical space. The critical space is that space with the greatest required fraction of outdoor air in the supply to this space.

V_{ot} = Corrected total outdoor airflow rate.

V_{st} = Total supply flow rate, i.e., the sum of all supply for all branches of the system.

V_{on} = Sum of outdoor airflow rates for all branches on system.

V_{oc} = Outdoor airflow rate required in critical spaces.

V_{sc} = Supply flow rate in critical space.

Comm 64.0403 (8) Alternative requirements.

(a) General. Except as specified in par. (d), each room served by a mechanical ventilation system shall be provided with the minimum outdoor airflow rate determined individually for each room, or the minimum amount of outside air may be supplied to the system if a minimum air change rate is provided in accordance with this subsection or waived in accordance with par. (c).

(b) Minimum air change.

1. Application.

a. The required air change shall be provided while people are present.

b. The air change rate may be based on actual room height or up to 10 feet (3048 mm) from the floor level of the room in question. The volume above 10 feet (3048 mm), in rooms that are more than 10 feet (3048 mm) in height, need not be considered in the air change requirement if the required air change is designed to occur in the lower 10 feet (3048 mm) of the occupied space.

c. The required minimum air change volume shall be transferred through the air-handling equipment where it is diluted or replaced with outside air, and supplied back to the space.

2. Six air changes per hour. Except as specified in subd. 3 and unless mechanical exhaust is required by Table 64.0403, the total air change rate for each room shall be at least six air changes per hour.

3. Less than six air changes per hour. An air change rate of less than six air changes per hour will be permitted where mechanical cooling (air conditioning) is provided to maintain an interior design temperature of 78°F (25°C) or lower and the heat gain requirement for the space has been satisfied. The air change rate may not be less than the minimum air changes per hour if specified in Table 64.0403.

Note: As specified in s. Comm 64.0403, the amount of outside air required must be maintained even if the air change rate is reduced.

(c) Air change requirement waived. The air change requirement for six air changes per hour may be omitted in any of the following applications:

1. Buildings or rooms utilizing spot heating as the only source of heat.

2. Buildings where the requirement for outside air is waived in accordance with sub. (4) (e).

3. Buildings utilizing natural ventilation as specified in IMC Section 402.

(d) Air change rates in health care facilities. Air change rates in health care facilities shall comply with the requirements in Table 2 or Table 6, as applicable, of AIA Guidelines for Design and Construction of Hospital and Health Care Facilities.

403.3.3 Variable air volume system control. Variable air volume air distribution systems, other than those designed

to supply only 100-percent outdoor air, shall be provided with controls to regulate the flow of outdoor air. Such control system shall be designed to maintain the flow of outdoor air at a rate of not less than that required by Section 403 over the entire range of supply air operating rates.

403.3.4 Balancing. Ventilation systems shall be balanced by an approved method. Such balancing shall verify that the ventilation system is capable of supplying the airflow rates required by Section 403.

SECTION 404
ENCLOSED PARKING GARAGES

404.1 [Comm 64.0404 (1)] Enclosed parking garages. Mechanical ventilation systems for enclosed parking garages are not required to operate continuously where the system meets all of the following:

(a) The system is arranged to operate automatically upon detection of carbon monoxide at a level of 35 parts per million (ppm) by automatic detection devices.

(b) If diesel fuel vehicles are stored, the system is arranged to operate automatically upon detection of nitrogen dioxide at a level of 1 part per million (ppm) by automatic detection devices.

(c) The system includes automatic controls for providing exhaust ventilation at a rate of 1/2 cfm per square foot for at least five hours in each 24-hour period.

(d) The system maintains the garage at negative or neutral pressure relative to other spaces.

404.2 [Comm 64.0404 (2)] Minimum ventilation. Automatic operation of the system shall not reduce the ventilation rate below 7.5 cfm per person and the system shall be capable of producing an exhaust rate of 0.5 cfm per square foot of floor area.

404.3 Occupied spaces accessory to public garages. Connecting offices, waiting rooms, ticket booths and similar uses that are accessory to a public garage shall be maintained at a positive pressure and shall be provided with ventilation in accordance with Section 403.3.

SECTION 405
SYSTEMS CONTROL

405.1 General. Mechanical ventilation systems shall be provided with manual or automatic controls that will operate such systems whenever the spaces are occupied. Air-conditioning systems that supply required ventilation air shall be provided with controls designed to automatically maintain the required outdoor air supply rate during occupancy.

SECTION 406
VENTILATION OF UNINHABITED SPACES

406.1 General. Uninhabited spaces, such as crawl spaces and attics, shall be provided with natural ventilation openings as required by the *International Building Code* or shall be provided with a mechanical exhaust and supply air system. The mechanical exhaust rate shall be not less than 0.02 cfm per square foot ($0.00001\ m^3/s \cdot m^2$) of horizontal area and shall be automatically controlled to operate when the relative humidity in the space served exceeds 60 percent.

CHAPTER 5
EXHAUST SYSTEMS

SECTION 501
GENERAL

501.1 Scope. This chapter shall govern the design, construction and installation of mechanical exhaust systems, including dust, stock and refuse conveyor systems and exhaust systems serving commercial food heat-processing appliances.

501.2 Independent system required. Single or combined mechanical exhaust systems from bath, toilet, urinal, locker, service sink closets and similar rooms shall be independent of all other exhaust systems. Type I exhaust systems shall be independent of all other exhaust systems except as provided in Section 506.3.6. Single or combined Type II exhaust systems for food-processing operations shall be independent of all other exhaust systems. Kitchen exhaust systems shall be constructed in accordance with Section 505 for domestic equipment and Sections 506 through 509 for commercial equipment.

501.3 Outdoor discharge. The air removed by every mechanical exhaust system shall be discharged outdoors at a point where it will not cause a nuisance and from which it cannot again be readily drawn in by a ventilating system. Air shall not be exhausted into an attic or crawl space.

> **Exception:** Whole-house ventilation-type attic fans that discharge into the attic space of dwelling units having private attics shall not be prohibited.

501.4 Pressure equalization. Mechanical exhaust systems shall be sized to remove the quantity of air required by this chapter to be exhausted. The system shall operate when air is required to be exhausted. Where mechanical exhaust is required in a room or space in other than occupancies in Group R-3, such space shall be maintained with a neutral or negative pressure. If a greater quantity of air is supplied by a mechanical ventilating supply system than is removed by a mechanical exhaust system for a room, adequate means shall be provided for the natural exit of the excess air supplied. If only a mechanical exhaust system is installed for a room or if a greater quantity of air is removed by a mechanical exhaust system than is supplied by a mechanical ventilating supply system for a room, adequate means shall be provided for the natural supply of the deficiency in the air supplied.

> **Comm 64.0501 Exception:** A mechanically exhausted room or space that is within a dwelling unit which is served by an independent heating, ventilating and air-conditioning system is not required to be maintained with negative or neutral pressure.

501.5 Ducts. Where exhaust duct construction is not specified in this chapter, such construction shall comply with Chapter 6.

SECTION 502
REQUIRED SYSTEMS

502.1 [Comm 64.0502] General. An exhaust system shall be provided, maintained and operated as specifically required by this section and for all occupied areas where machines, vats, tanks, furnaces, forges, salamanders and other appliances, equipment and processes in such areas produce or throw off dust or particles sufficiently light to float in the air, or which emit heat, odors, fumes, spray, gas or smoke, in such quantities so as to be injurious to health or safety.

502.1.1 Exhaust location. The inlet to an exhaust system shall be located in the area of heaviest concentration of contaminants.

[F] 502.1.2 Fuel-dispensing areas. The bottom of an air inlet or exhaust opening in fuel-dispensing areas shall be located not more than 18 inches (457 mm) above the floor.

502.1.3 Equipment, appliance and service rooms. Equipment, appliance and system service rooms that house sources of odors, fumes, noxious gases, smoke, steam, dust, spray or other contaminants shall be designed and constructed so as to prevent spreading of such contaminants to other occupied parts of the building.

[F] 502.1.4 Hazardous exhaust. The mechanical exhaust of high concentrations of dust or hazardous vapors shall conform to the requirements of Section 510.

[F] 502.2 Aircraft fueling and defueling. Compartments housing piping, pumps, air eliminators, water separators, hose reels and similar equipment used in aircraft fueling and defueling operations shall be adequately ventilated at floor level or within the floor itself.

[F] 502.3 Battery-charging areas. Ventilation shall be provided in an approved manner in battery-charging areas to prevent a dangerous accumulation of flammable gases.

[F] 502.4 Stationary lead-acid battery systems. Ventilation shall be provided for stationary lead-acid battery systems in accordance with this chapter and Section 502.4.1 or 502.4.2.

[F] 502.4.1 Hydrogen limit. The ventilation system shall be designed to limit the maximum concentration of hydrogen to 1.0 percent of the total volume of the room.

[F] 502.4.2 Ventilation rate. Continuous ventilation shall be provided at a rate of not less than 1 cubic foot per minute per square foot (cfm/ft^2) [0.00508 m^3/(s · m^2)] of floor area of the room.

[F] 502.5 Dry cleaning plants. Ventilation in dry cleaning plants shall be adequate to protect employees and the public in accordance with this section and DOL 29 CFR Part 1910.1000, where applicable.

[F] 502.5.1 Type II systems. Type II dry cleaning systems shall be provided with a mechanical ventilation system that

is designed to exhaust 1 cubic foot of air per minute for each square foot of floor area (1 cfm/ft^2) [0.00508 m^3/(s · m^2)] in dry cleaning rooms and in drying rooms. The ventilation system shall operate automatically when the dry cleaning equipment is in operation and shall have manual controls at an approved location.

[F] 502.5.2 Type IV and V systems. Type IV and V dry cleaning systems shall be provided with an automatically activated exhaust ventilation system to maintain a minimum of 100 feet per minute (50.8 m/s) air velocity through the loading door when the door is opened.

Exception: Dry cleaning units are not required to be provided with exhaust ventilation where an exhaust hood is installed immediately outside of and above the loading door which operates at an airflow rate as follows:

$$Q = 100 \times A_{LD} \quad \textbf{(Equation 5-1)}$$

where:

Q = Flow rate exhausted through the hood, cubic feet per minute.

A_{LD} = Area of the loading door, square feet.

[F] 502.5.3 Spotting and pretreating. Scrubbing tubs, scouring, brushing or spotting operations shall be located such that solvent vapors are captured and exhausted by the ventilating system.

[F] 502.6 Application of flammable finishes. Mechanical exhaust as required by this section shall be provided for operations involving the application of flammable finishes.

[F] 502.6.1 During construction. Ventilation shall be provided for operations involving the application of materials containing flammable solvents in the course of construction, alteration or demolition of a structure.

[F] 502.6.2 Limited spraying spaces. Positive mechanical ventilation which provides a minimum of six complete air changes per hour shall be installed in limited spraying spaces. Such system shall meet the requirements of the *International Fire Code* for handling flammable vapors. Explosion venting is not required.

[F] 502.6.3 Spraying areas. Mechanical ventilation of spraying areas shall be provided in accordance with Sections 502.6.3.1 through 502.6.3.7.

502.6.3.1 Operation. Mechanical ventilation shall be kept in operation at all times while spraying operations are being conducted and for a sufficient time thereafter to allow vapors from drying coated articles and finishing material residue to be exhausted. Spraying equipment shall be interlocked with the ventilation of the spraying area such that spraying operations cannot be conducted unless the ventilation system is in operation.

502.6.3.2 Recirculation. Air exhausted from spraying operations shall not be recirculated.

Exceptions:

1. Air exhausted from spraying operations shall be permitted to be recirculated as makeup air for unmanned spray operations provided that:
   1.1. Solid particulate has been removed.
   1.2. The vapor concentration is less than 25 percent of the lower flammablity limit (LFL).
   1.3. Approved equipment is used to monitor the vapor concentration.
   1.4. An alarm is sounded and spray operations are automatically shut down if the vapor concentration exceeds 25 percent of the LFL.
   1.5. The spray booths, spray spaces or spray rooms involved in any recirculation process shall be provided with mechanical ventilation that shall automatically exhaust 100 percent of the required air volume in the event of shutdown by approved equipment used to monitor vapor concentrations.
2. Air exhausted from spraying operations shall be permitted to be recirculated as makeup air to manned spraying operations if all of the conditions provided in Exception 1 are included in the installation and documents have been prepared to show that the installation does not present life safety hazards to personnel inside the spray booth, spray space or spray room.

502.6.3.3 Air velocity. Ventilation systems shall be designed, installed and maintained such that the average air velocity over the open face of the booth, or booth cross sectional in the direction of airflow during spraying operations, is not less than 100 feet per minute (0.51 m/s).

502.6.3.4 Ventilation obstruction. Articles being sprayed shall be positioned in a manner that does not obstruct collection of overspray.

502.6.3.5 Independent ducts. Each spray booth and spray room shall have an independent exhaust duct system discharging to the outdoors.

Exceptions:

1. Multiple spray booths having a combined frontal area of 18 square feet (1.67 m^2) or less are allowed to have a common exhaust where identical spray-finishing material is used in each booth. If more than one fan serves one booth, such fans shall be interconnected so that all fans operate simultaneously.
2. Where treatment of exhaust is necessary for air pollution control or energy conservation, ducts shall be allowed to be manifolded if all of the following conditions are met:
   2.1. The sprayed materials used are compatible and will not react or cause ignition of the residue in the ducts.
   2.2. Nitrocellulose-based finishing material shall not be used.
   2.3. A filtering system shall be provided to reduce the amount of overspray carried into the duct manifold.
   2.4. Automatic sprinkler protection shall be provided at the junction of each booth

panels with wording as follows: "ACCESS PANEL. DO NOT OBSTRUCT."

506.3.13 Type I exhaust outlets. Exhaust outlets for grease ducts serving commercial food heat-processing appliances shall conform to the requirements of Sections 506.3.13.1 through 506.3.13.3.

506.3.13.1 Termination above the roof. Exhaust outlets that terminate above the roof shall have the discharge opening located not less than 40 inches (1016 mm) above the roof surface.

506.3.13.2 Termination through an exterior wall. Exhaust outlets shall be permitted to terminate through exterior walls where the smoke, grease, gases, vapors, and odors in the discharge from such terminations do not create a public nuisance or a fire hazard. Such terminations shall not be located where protected openings are required by the *International Building Code*. Other exterior openings shall not be located within 3 feet (914 mm) of such terminations.

506.3.13.3 Termination location. Exhaust outlets shall be located not less than 10 feet (3048 mm) horizontally from parts of the same or contiguous buildings, adjacent property lines and air intake openings into any building and shall be located not less than 10 feet (3048 mm) above the adjoining grade level.

Exceptions:

1. Exhaust outlets shall terminate not less than 5 feet (1524 mm) from an adjacent building, adjacent property line and air intake openings into a building where air from the exhaust outlet discharges away from such locations.
2. The minimum horizontal distance between vertical discharge fans and parapet-type building structures shall be 2 feet (610 mm) provided that such structures are not higher than the top of the fan discharge opening.

506.4 Ducts serving Type II hoods. Commercial kitchen exhaust systems serving Type II hoods shall comply with Sections 506.4.1 and 506.4.2.

506.4.1 Type II exhaust outlets. Exhaust outlets for ducts serving Type II hoods shall comply with Sections 401.5 and 401.5.2. Such outlets shall be protected against local weather conditions and shall meet the provisions for exterior wall opening protectives in accordance with the *International Building Code.*

506.4.2 Ducts. Ducts and plenums serving Type II hoods shall be constructed of rigid metallic materials. Duct construction, installation, bracing and supports shall comply with Chapter 6. Ducts subject to positive pressure and ducts conveying moisture-laden or waste-heat-laden air shall be constructed, joined and sealed in an approved manner.

SECTION 507
COMMERCIAL KITCHEN HOODS

507.1 General. Commercial kitchen exhaust hoods shall comply with the requirements of this section. Hoods shall be Type I or Type II and shall be designed to capture and confine cooking vapors and residues.

Exception: Factory-built commercial exhaust hoods which are tested in accordance with UL 710, listed, labeled and installed in accordance with Section 304.1 shall not be required to comply with Sections 507.4, 507.5, 507.7, 507.12, 507.13, 507.15 and 507.16.

507.2 Where required. A Type I or Type II hood shall be installed at or above all commercial food heat-processing appliances. A Type II hood shall be installed above commercial dishwashing machines.

Exceptions:

1. Food heat-processing appliances installed within a dwelling unit.
2. Under-counter-type commercial dishwashing machines.

507.2.1 Type I and Type II hoods. A Type I hood shall be installed at or above all commercial food heat-processing appliances that produce grease vapors or smoke. A Type I or Type II hood shall be installed at or above all commercial food heat-processing appliances that produce fumes, steam, odor or heat.

507.2.2 Domestic cooking appliances used for commercial purposes. Domestic cooking appliances utilized for commercial purposes shall be provided with Type I or II hoods as required for the type of appliances and processes in accordance with Sections 507.2 and 507.2.1.

507.2.3 Solid fuel. Type I hoods for use over solid fuel-burning cooking appliances shall discharge to an exhaust system that is independent of other exhaust systems.

507.3 Fuel-burning appliances. Where vented fuel-burning appliances are located in the same room or space as the hood, provisions shall be made to prevent the hood system from interfering with normal operation of the appliance vents.

507.4 Type I materials. Type I hoods shall be constructed of steel not less than 0.043 inch (1.09 mm) (No. 18 MSG) in thickness, or stainless steel not less than 0.037 inch (0.94 mm) (No. 20 MSG) in thickness.

507.5 Type II hood materials. Type II hoods shall be constructed of steel not less than 0.030 inch (0.76 mm) (No. 22 Gage) in thickness, stainless steel not less than 0.024 inch (0.61 mm) (No. 24 Gage) in thickness, copper sheets weighing not less than 24 ounces per square foot (7.3 kg/m^2), or of other approved material and gage.

507.6 Supports. Type I hoods shall be secured in place by noncombustible supports. All Type I and Type II hood supports shall be adequate for the applied load of the hood, the unsupported ductwork, the effluent loading, and the possible weight of personnel working in or on the hood.

507.7 Hood joints, seams and penetrations. Hood joints, seams and penetrations shall comply with Sections 507.7.1 and 507.7.2.

507.7.1 Type I hoods. External hood joints, seams and penetrations for Type I hoods shall be made with a continuous external liquid-tight weld or braze to the lowest outermost perimeter of the hood. Internal hood joints, seams, penetrations, filter support frames, and other appendages attached inside the hood shall not be required to be welded or brazed but shall be otherwise sealed to be grease tight.

Exceptions:

1. Penetrations shall not be required to be welded or brazed where sealed by devices that are listed for the application.
2. Internal welding or brazing of seams, joints, and penetrations of the hood shall not be prohibited provided that the joint is formed smooth or ground so as to not trap grease, and is readily cleanable.
3. External hood joints and seams tested and listed in accordance with the requirements of UL 710 shall not be required to be welded or brazed.

507.7.2 Type II hoods. Joints, seams and penetrations for Type II hoods shall be constructed as set forth in Chapter 6, shall be sealed on the interior of the hood and shall provide a smooth surface that is readily cleanable and water tight.

507.8 Cleaning and grease gutters. A hood shall be designed to provide for thorough cleaning of the entire hood. Grease gutters shall drain to an approved collection receptacle that is fabricated, designed and installed to allow access for cleaning.

507.9 Clearances for Type I hood. A Type I hood shall be installed with a clearance to combustibles of not less than 18 inches (457 mm).

Exception: Clearance shall not be required from gypsum wallboard attached to noncombustible structures provided that a smooth, cleanable, nonabsorbent and noncombustible material is installed between the hood and the gypsum wallboard over an area extending not less than 18 inches (457 mm) in all directions from the hood.

507.10 Hoods penetrating a ceiling. Type I hoods or portions thereof penetrating a ceiling, wall or furred space shall comply with all the requirements of Section 506.3.11.

507.11 Grease filters. Type I hoods shall be equipped with listed grease filters designed for the specific purpose. Grease-collecting equipment shall be provided with access for cleaning. The lowest edge of a grease filter located above the cooking surface shall be not less than the height specified in Table 507.11.

TABLE 507.11
MINIMUM DISTANCE BETWEEN THE LOWEST EDGE OF A GREASE FILTER AND THE COOKING SURFACE OR THE HEATING SURFACE

TYPE OF COOKING APPLIANCE	HEIGHT ABOVE COOKING SURFACE (feet)
Without exposed flame	0.5
Exposed flame and burners	2
Exposed charcoal and charbroil type	3.5

For SI: 1 foot = 304.8 mm.

507.11.1 Criteria. Filters shall be of such size, type and arrangement as will permit the required quantity of air to pass through such units at rates not exceeding those for which the filter or unit was designed or approved. Filter units shall be installed in frames or holders so as to be readily removable without the use of separate tools, unless designed and installed to be cleaned in place and the system is equipped for such cleaning in place. Removable filter units shall be of a size that will allow them to be cleaned in a dishwashing machine or pot sink. Filter units shall be arranged in place or provided with drip-intercepting devices to prevent grease or other condensate from dripping into food or on food preparation surfaces.

507.11.2 Mounting position. Filters shall be installed at an angle of not less than 45 degrees (0.79 rad) from the horizontal and shall be equipped with a drip tray beneath the lower edge of the filters.

507.12 Canopy size and location. The inside lower edge of canopy-type commercial cooking hoods shall overhang or extend a horizontal distance of not less than 6 inches (152 mm) beyond the edge of the cooking surface, on all open sides. The vertical distance between the front lower lip of the hood and the cooking surface shall not exceed 4 feet (1219 mm).

Exception: The hood shall be permitted to be flush with the outer edge of the cooking surface where the hood is closed to the appliance side by a noncombustible wall or panel.

507.13 [Comm 64.0507] Capacity of hoods. A kitchen exhaust hood shall be provided with a capture velocity to capture the grease vapors effectively and may be designed through engineering analysis, or based on this section and the requirements in IMC Sections 507.13.1 through 507.13.4.

where:

A = The horizontal surface area of the hood, in square feet (m^2).

D = Distance in feet (m) between the lower lip of the hood and the cooking surface.

P = That part of the perimeter of the hood that is open, in feet (m).

Q = Quantity of air, in cubic feet per minute (m^3/s).

507.13.1 Solid fuel-burning cooking appliances. The minimum airflow for Type I hoods used for solid fuel-burning cooking appliances, grease-burning charbroilers and similar appliances shall be:

Number of exposed sides	Formula	
		For SI:
4 (island or central hood)	$Q = 300A$	$Q = 1.52A$
3 or less	$Q = 200A$	$Q = 1.02A$
Alternate formula	$Q = 100PD$	$Q = 0.51PD$

507.13.2 High temperature. The minimum airflow for Type I hoods used for high-temperature appliances such as deep-fat fryers shall be determined as follows:

Number of exposed sides	Formula	
		For SI:
4 (island or central hood)	$Q = 150A$	$Q = 0.76A$
3 or less	$Q = 100A$	$Q = 0.51A$
Alternate formula	$Q = 100PD$	$Q = 0.51PD$

ducts during floods up to the base flood elevation. If the ducts are located below the base flood elevation, the ducts shall be capable of resisting hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding to the base flood elevation.

603.7.4 Plastic ducts and fittings. Plastic ducts shall be constructed of PVC having a minimum pipe stiffness of 8 psi (55 kPa) at 5-percent deflection when tested in accordance with ASTM D 2412. Plastic duct fittings shall be constructed of either PVC or high-density polyethylene. Plastic duct and fittings shall be utilized in underground installations only. The maximum design temperature for systems utilizing plastic duct and fittings shall be 150°F (66°C).

603.8 Joints, seams and connections. All longitudinal and transverse joints, seams and connections shall be securely fastened and sealed in accordance with the *International Energy Conservation Code*.

603.9 Supports. Ducts shall be supported with approved hangers at intervals not exceeding 10 feet (3048 mm) or by other approved duct support systems designed in accordance with the *International Building Code*. Flexible and other factory-made ducts shall be supported in accordance with the manufacturer's installation instructions.

603.10 Furnace connections. Ducts connecting to a furnace shall have a clearance to combustibles in accordance with the furnace manufacturer's installation instructions.

603.11 Condensation. Provisions shall be made to prevent the formation of condensation on the exterior of any duct.

603.12 Location. Ducts shall not be installed in or within 4 inches (102 mm) of the earth, except where such ducts comply with Section 603.7.

603.13 Mechanical protection. Ducts installed in locations where they are exposed to mechanical damage by vehicles or from other causes shall be protected by approved barriers.

603.14 Weather protection. All ducts including linings, coverings and vibration isolation connectors installed on the exterior of the building shall be adequately protected against the elements.

603.15 Registers, grilles and diffusers. Duct registers, grilles and diffusers shall be installed in accordance with the manufacturer's installation instructions. Balancing dampers or other means of supply air adjustment shall be provided in the branch ducts or at each individual duct register, grille or diffuser.

603.15.1 Floor registers. Floor registers shall resist, without structural failure, a 200-pound (890 N) concentrated load on a 2-inch-diameter (51 mm) disc applied to the most critical area of the exposed face.

Comm 64.0300 Specific criteria for operating rooms and autopsy rooms. In operating rooms of hospitals and ambulatory surgery center rooms and autopsy rooms, the bottoms of ventilation supply and return openings shall be at least 3 inches (76 mm) above the floor.

SECTION 604
INSULATION

604.1 General. Duct insulation shall conform to the requirements of Sections 604.2 through 604.11 and the *International Energy Conservation Code*.

604.2 Surface temperature. Ducts that operate at temperatures exceeding 120°F (49°C) shall have sufficient thermal insulation to limit the exposed surface temperature to 120°F (49°C).

604.3 Coverings and linings. Coverings and linings, including adhesives when used, shall have a flame spread index not more than 25 and a smoke-developed index not more than 50, when tested in accordance with ASTM E 84. Duct coverings and linings shall not flame, glow, smolder or smoke when tested in accordance with ASTM C 411 at the temperature to which they are exposed in service. The test temperature shall not fall below 250°F (121°C).

604.4 Foam plastic insulation. Foam plastic shall conform to the requirements of Section 604 and the *International Building Code*.

604.5 Appliance insulation. Listed and labeled appliances that are internally insulated shall be considered as conforming to the requirements of Section 604.

604.6 Penetration of assemblies. Duct coverings shall not penetrate a wall or floor required to have a fire-resistance rating or required to be fireblocked.

604.7 Identification. External duct insulation and factory-insulated flexible duct shall be legibly printed or identified at intervals not greater than 36 inches (914 mm) with the name of the manufacturer; the thermal resistance *R*-value at the specified installed thickness; and the flame spread and smoke-developed indexes of the composite materials. All duct insulation product *R*-values shall be based on insulation only, excluding air films, vapor retarders, or other duct components, and shall be based on tested *C*-values at 75°F (24°C) mean temperature at the installed thickness, in accordance with recognized industry procedures. The installed thickness of duct insulation used to determine its *R*-values shall be determined as follows:

1. For duct board, duct liner and factory-made rigid ducts not normally subjected to compression, the nominal insulation thickness shall be used.
2. For duct wrap, the installed thickness shall be assumed to be 75 percent (25-percent compression) of nominal thickness.
3. For factory-made flexible air ducts, the installed thickness shall be determined by dividing the difference between the actual outside diameter and nominal inside diameter by two.

604.8 Lining installation. Linings shall be interrupted at the area of operation of a fire damper and at a minimum of 6 inches (152 mm) upstream of and 6 inches (152 mm) downstream of electric-resistance and fuel-burning heaters in a duct system. Metal nosings or sleeves shall be installed over exposed duct liner edges that face opposite the direction of airflow.

Comm 64.0604 (1) General.

(a) 1. Except as provided under subd. 2., in hospitals and ambulatory surgery centers, duct linings exposed to air movement shall not be used in ducts serving operating rooms, delivery rooms, labor, delivery and recovery rooms, nurseries, protective environment rooms and critical care units.

2. In hospitals and ambulatory surgery centers, the requirement in subd. 1. does not apply to mixing boxes and acoustical traps that have special coverings over such lining to mitigate fungal and microbial growth.

(b) In hospitals and ambulatory surgery centers, duct lining shall not be installed within 15 feet (4572 mm) downstream of humidifiers or as necessary to prevent moisture accumulation in the lining.

Comm 64.0604 (3) Exception: The distances from a listed duct lining to a heater may be reduced in accordance with the duct lining listing.

604.9 Thermal continuity. Where a duct liner has been interrupted, a duct covering of equal thermal performance shall be installed.

604.10 Service openings. Service openings shall not be concealed by duct coverings unless the exact location of the opening is properly identified.

604.11 Vapor retarders. Where ducts used for cooling are externally insulated, the insulation shall be covered with a vapor retarder having a maximum permeance of 0.05 perm [2.87 ng/(Pa · s · m^2)] or aluminum foil having a minimum thickness of 2 mils (0.051 mm). Insulations having a permeance of 0.05 perms [2.87 ng/(Pa · s · m^2)] or less shall not be required to be covered. All joints and seams shall be sealed to maintain the continuity of the vapor retarder.

604.12 Weatherproof barriers. Insulated exterior ducts shall be protected with an approved weatherproof barrier.

604.13 Internal insulation. Materials used as internal insulation and exposed to the airstream in ducts shall be shown to be durable when tested in accordance with UL 181. Exposed internal insulation that is not impermeable to water shall not be used to line ducts or plenums from the exit of a cooling coil to the downstream end of the drain pan.

SECTION 605
AIR FILTERS

605.1 General. Heating and air-conditioning systems of the central type shall be provided with approved air filters. Filters shall be installed in the return air system, upstream from any heat exchanger or coil, in an approved convenient location. Liquid adhesive coatings used on filters shall have a flash point not lower than 325°F (163°C).

Comm 64.0605 Exceptions:

(1) Central air-handling systems in hospitals, nursing homes and ambulatory surgery centers shall comply with the applicable filtration requirements specified in section 7.31.D8, 8.31.D5, 9.31.D8 or 11.31.D4 of the AIA Guidelines for Design and Construction of Hospital and Health Care Facilities.

(2) Noncentral air-handling systems in hospitals, nursing homes and ambulatory surgery centers shall be equipped with permanent cleanable or replaceable filters with a minimum efficiency of 68 percent weight arrestance.

(3) In hospitals and ambulatory surgery centers, noncentral air-handling systems shall be used as recirculating units only. All outdoor air requirements shall be met by a separate central air-handling system with the filtration as provided in sub. (1).

(4) Preheat coils for snow melting that are single row, have a maximum 8 fins per inch, are accessible for pressure washing and have ductwork that is designed for drainage need not be provided with air filters.

605.2 Approval. Media-type and electrostatic-type air filters shall be listed and labeled. Air filters utilized within dwelling units shall be designed for the intended application and shall not be required to be listed and labeled.

605.3 Airflow over the filter. Ducts shall be constructed to allow an even distribution of air over the entire filter.

SECTION 606
SMOKE DETECTION SYSTEMS CONTROL

606.1 Controls required. Air distribution systems shall be equipped with smoke detectors listed and labeled for installation in air distribution systems, as required by this section.

606.2 Where required. Smoke detectors shall be installed where indicated in Sections 606.2.1 through 606.2.3.

Exception: Smoke detectors shall not be required where air distribution systems are incapable of spreading smoke beyond the enclosing walls, floors and ceilings of the room or space in which the smoke is generated.

606.2.1 Return air systems. Smoke detectors shall be installed in return air systems with a design capacity greater than 2,000 cfm (0.9 m^3/s), in the return air duct or plenum upstream of any filters, exhaust air connections, outdoor air connections, or decontamination equipment and appliances.

Comm 64.0606 (1) Note: For DHFS licensed healthcare facilities, as specified in chs. HFS 124, 131, 132, and 134, also refer to NFPA standard 90A section 4-4.2A for air handling units between 2,000 cfm and 15,000 cfm.

Exception: Smoke detectors are not required in the return air system where the space served by the air distribution system is protected by a system of area smoke detectors in accordance with the *International Building Code*. The area smoke detector system shall comply with Section 606.4.

606.2.2 Common supply and return air systems. Where multiple air-handling systems share common supply or return air ducts or plenums with a combined design capacity greater than 2,000 cfm (0.9 m^3/s), the return air system shall be provided with smoke detectors in accordance with Section 606.2.1.

Exception: Individual smoke detectors shall not be required for each variable air volume (VAV) zone unit or

VAV-type fan-powered terminal unit, provided that such units do not have an individual design capacity greater than 2,000 cfm (0.9 m^3/s) and will be shut down by activation of one of the following:

1. Smoke detectors required by Sections 606.2.1 and 606.2.3.
2. An approved area smoke detector system located in the return air plenum serving such units.
3. An area smoke detector system as prescribed in the exception to Section 606.2.1.

In all cases, the smoke detectors shall comply with Sections 606.4 and 606.4.1.

606.2.3 Return air risers. Where return air risers serve two or more stories and are part of a return air system having a design capacity greater than 15,000 cfm (7.1 m^3/s), smoke detectors shall be installed at each story. Such smoke detectors shall be located upstream of the connection between the return air riser and any air ducts or plenums.

606.3 Installation. Smoke detectors required by this section shall be installed in accordance with NFPA 72. The required smoke detectors shall be installed to monitor the entire airflow conveyed by the system including return air and exhaust or relief air. Access shall be provided to smoke detectors for inspection and maintenance.

606.4 Controls operation. Upon activation, the smoke detectors shall shut down the air distribution system. Air distribution systems that are part of a smoke control system shall switch to the smoke control mode upon activation of a detector.

606.4.1 Supervision. The smoke detectors shall be connected to a fire alarm system. The actuation of a smoke detector shall activate a visible and audible supervisory signal at a constantly attended location.

Exceptions:

1. The supervisory signal at a constantly attended location is not required where the smoke detector activates the building's alarm-indicating appliances.
2. In occupancies not required to be equipped with a fire alarm system, actuation of a smoke detector shall activate a visible and an audible signal in an approved location. Smoke detector trouble conditions shall activate a visible or audible signal in an approved location and shall be identified as air duct detector trouble.

Comm 64.0606 (2) Note: For DHFS licensed healthcare facilities as specified in chs. HFS 124, 131, 132, and 134, also refer to NFPA standard 90A section 4-3.2 for smoke dampers isolating air handling units.

[B] SECTION 607
DUCTS AND AIR TRANSFER OPENINGS

607.1 General. The provisions of this section shall govern the protection of duct penetrations and air transfer openings in fire-resistance-rated assemblies.

607.1.1 Ducts and air transfer openings without dampers. Ducts and air transfer openings that penetrate fire-resistant-rated assemblies and are not required to have dampers by this section shall comply with the requirements of Section 711 of the *International Building Code*.

607.2 Installation. Fire dampers, smoke dampers, combination fire/smoke dampers and ceiling dampers located within air distribution and smoke control systems shall be installed in accordance with the requirements of this section, and the manufacturer's installation instructions and listing.

607.2.1 Smoke control system. Where the installation of a fire damper will interfere with the operation of a required smoke control system in accordance with Section 513, approved alternative protection shall be utilized.

607.2.2 Hazardous exhaust ducts. Fire dampers for hazardous exhaust duct systems shall comply with Section 510.

607.3 Damper testing and ratings. Dampers shall be listed and bear the label of an approved testing agency indicating compliance with the standards in this section. Fire dampers shall comply with the requirements of UL 555. Only fire dampers labeled for use in dynamic systems shall be installed in heating, ventilation and air-conditioning systems designed to operate with fans on during a fire. Smoke dampers shall comply with the requirements of UL 555S. Combination fire/smoke dampers shall comply with the requirements of both UL 555 and 555S. Ceiling radiation dampers shall comply with the requirements of UL 555C.

607.3.1 Fire protection rating. Fire dampers shall have the minimum fire protection rating specified in Table 607.3.1 for the type of penetration.

607.3.1.1 Fire damper actuating device. The fire damper actuating device shall meet one of the following requirements:

1. The operating temperature shall be approximately 50°F (27.8°C) above the normal temperature within the duct system, but not less than 160°F (71°C).
2. The operating temperature shall be not more than 286°F (141°C) where located in a smoke control system complying with Section 513.
3. Where a combination fire/smoke damper is located in a smoke control system complying with Section 513, the operating temperature rating shall be approximately 50°F (27.8°C) above the maximum smoke control system designed operating temperature, or a maximum temperature of 350°F (177°C). The temperature shall not exceed the UL 555S degradation test temperature rating for a combination fire/smoke damper.

TABLE 607.3.1
FIRE DAMPER RATING

TYPE OF PENETRATION	MINIMUM DAMPER RATING (hour)
Less than 3-hour fire-resistance-rated assemblies	$1^1/_2$
3-hour or greater fire-resistance-rated assemblies	3

607.3.2 Smoke damper ratings. Smoke damper leakage ratings shall not be less than Class II. Elevated temperature ratings shall be not less than 250°F (121°C).

607.3.2.1 Smoke damper actuation methods. The smoke damper shall close upon actuation of a listed smoke detector or detectors installed in accordance with Section 907.10 and one of the following methods, as applicable:

1. Where a damper is installed within a duct, a smoke detector shall be installed in the duct within 5 feet (1524 mm) of the damper with no air outlets or inlets between the detector and the damper. The detector shall be listed for the air velocity, temperature and humidity anticipated at the point where it is installed. Other than in mechanical smoke control systems, dampers shall be closed upon fan shutdown where local smoke detectors require a minimum velocity to operate.
2. Where a damper is installed above smoke barrier doors in a smoke barrier, a spot-type detector listed for releasing service shall be installed on either side of the smoke barrier door opening.
3. Where a damper is installed within an unducted opening in a wall, spot-type detector listed for releasing service shall be installed within 5 feet (1524 mm) horizontally of the damper.
4. Where a damper is installed in a corridor wall, the damper shall be permitted to be controlled by a smoke detection system installed in the corridor.
5. Where a total-coverage smoke detector system is provided within areas served by an HVAC system, dampers shall be permitted to be controlled by the smoke detection system.

607.4 Access and identification. Fire and smoke dampers shall be provided with an approved means of access, large enough to permit inspection and maintenance of the damper and its operating parts. The access shall not affect the integrity of fire-resistance-rated assemblies. The access openings shall not reduce the fire-resistance rating of the assembly. Access points shall be permanently identified on the exterior by a label having letters not less than 0.5 inch (12.7 mm) in height reading: SMOKE DAMPER or FIRE DAMPER. Access doors in ducts shall be tight fitting and suitable for the required duct construction.

607.5 Where required. Fire dampers, smoke dampers, combination fire/smoke dampers and ceiling radiation dampers shall be provided at the location prescribed in this section. Where an assembly is required to have both fire dampers and smoke dampers, combination fire/smoke dampers or a fire damper and a smoke damper shall be required.

607.5.1 Fire walls. Ducts and air transfer openings permitted in fire walls in accordance with Section 705.11 of the *International Building Code* shall be protected with approved fire dampers installed in accordance with their listing.

607.5.2 Fire barriers. Duct penetrations and air transfer openings in fire barriers shall be protected with approved fire dampers installed in accordance with their listing.

Exceptions: Fire dampers are not required at penetrations of fire barriers where any of the following apply:

1. Penetrations are tested in accordance with ASTM E 119 as part of the fire-resistance rated assembly.
2. Ducts are used as part of an approved smoke control system in accordance with Section 513.
3. Such walls are penetrated by ducted HVAC systems, have a required fire-resistance rating of 1 hour or less, are in areas of other than Group H and are in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 of the *International Building Code*.

607.5.3 Fire partitions. Duct penetrations in fire partitions shall be protected with approved fire dampers installed in accordance with their listing.

Exceptions: In occupancies other than Group H, fire dampers are not required where any of the following apply:

1. The partitions are tenant separation and corridor walls in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 of the *International Building Code*.
2. The duct system is constructed of approved materials in accordance with this code and the duct penetrating the wall meets all of the following minimum requirements:
   2.1. The duct shall not exceed 100 square inches (0.06 m^2).
   2.2. The duct shall be constructed of steel a minimum of 0.0217 inch (0.55 mm) in thickness.
   2.3. The duct shall not have openings that communicate the corridor with adjacent spaces or rooms.
   2.4. The duct shall be installed above a ceiling.
   2.5. The duct shall not terminate at a wall register in the fire-resistance-rated wall.

607.5.4 Corridors/smoke barriers. A listed smoke damper designed to resist the passage of smoke shall be provided at each point a duct or air transfer opening penetrates a smoke barrier wall or a corridor wall required to have smoke and draft control doors in accordance with the *International Building Code*.

Exceptions:

1. Smoke dampers are not required in corridor penetrations where the building is equipped throughout with an approved smoke control system in accordance with Section 513 and smoke dampers are not necessary for the operation and control of the system.
2. Smoke dampers are not required in smoke barrier penetrations where the openings in ducts are limited to a single smoke compartment and the ducts are constructed of steel.

3. Smoke dampers are not required in corridor penetrations where the duct is constructed of steel not less than 0.019 inch (0.48 mm) in thickness and there are no openings serving the corridor.

607.5.4.1 Smoke damper. The smoke damper shall close upon actuation of a listed smoke detector or detectors installed in accordance with the *International Building Code* and one of the following methods, as applicable:

1. Where a damper is installed within a duct, a smoke detector shall be installed in the duct within 5 feet (1524 mm) of the damper with no air outlets or inlets between the detector and the damper. The detector shall be listed for the air velocity, temperature and humidity anticipated at the point where it is installed.
2. Where a damper is installed above smoke barrier doors in a smoke barrier, a spot-type detector listed for releasing service shall be installed on either side of the smoke barrier door opening.
3. Where a damper is installed within an unducted opening in a wall, a spot-type detector listed for releasing service shall be installed within 5 feet (1524 mm) horizontally of the damper.
4. Where a damper is installed in a corridor wall, the damper shall be permitted to be controlled by a smoke detection system installed in the corridor.
5. Where a total-coverage smoke detector system is provided within all areas served by an HVAC system, dampers shall be permitted to be controlled by the smoke detection system.

607.5.5 Shaft enclosures. Ducts and air transfer openings shall not penetrate a shaft serving as an exit enclosure except as permitted by Section 1005.3.4.1 of the *International Building Code.*

607.5.5.1 Penetrations of shaft enclosures. Shaft enclosures that are permitted to be penetrated by ducts and air transfer openings shall be protected with approved fire and smoke dampers installed in accordance with their listing.

Exceptions: Fire dampers are not required at penetrations of shafts where:

1. Steel exhaust subducts extend at least 22 inches (559 mm) vertically in exhaust provided there is a continuous airflow upward to the outside.
2. Penetrations are tested in accordance with ASTM E 119 as part of the fire-resistance rated assembly.
3. Ducts are used as part of an approved smoke-control system in accordance with Section 909 of the International Building Code.
4. The penetrations are in parking garage exhaust or supply shafts that are separated from other buildings shafts by not less than 2-hour fire-resistance-rated construction.

607.6 Horizontal assemblies. Penetrations by air ducts of a floor, floor/ceiling assembly or the ceiling membrane of a roof/ceiling assembly shall be protected by a shaft enclosure that complies with the *International Building Code* or shall comply with this section.

607.6.1 Through penetrations. In occupancies other than Groups I-2 and I-3, a duct and air transfer opening system constructed of approved materials in accordance with this code that penetrates a fire-resistance-rated floor/ceiling assembly that connects not more than two stories is permitted without shaft enclosure protection provided a fire damper is installed at the floor line.

607.6.2 Membrane penetrations. Where duct systems constructed of approved materials in accordance with this code penetrate a ceiling of a fire-resistance-rated floor/ceiling or roof/ceiling assembly, shaft enclosure protection is not required provided an approved ceiling radiation damper is installed at the ceiling line. Where a duct is not attached to a diffuser that penetrates a ceiling of a fire-resistance-rated floor/ceiling or roof/ceiling assembly, shaft enclosure protection is not required provided an approved ceiling radiation damper is installed at the ceiling line. Ceiling radiation dampers shall be installed in accordance with UL 555C and constructed in accordance with the details listed in a fire-resistance-rated assembly or shall be labeled to function as a heat barrier for air-handling outlet/inlet penetrations in the ceiling of a fire-resistance-rated assembly. Ceiling radiation dampers shall not be required where ASTM E 119 fire tests have shown that ceiling radiation dampers are not necessary in order to maintain the fire-resistance rating of the assembly.

607.6.3 Nonfire-resistance-rated assemblies. Duct systems constructed of approved materials in accordance with this code that penetrate nonfire-resistance-rated floor assemblies that connect not more than two stories are permitted without shaft enclosure protection provided that the annular space between the assembly and the penetrating duct is filled with an approved noncombustible material to resist the free passage of flame and the products of combustion. Duct systems constructed of approved materials in accordance with this code that penetrate non-rated floor assemblies that connect not more than three stories are permitted without shaft enclosure protection provided that the annular space between the assembly and the penetrating duct is filled with an approved noncombustible material to resist the free passage of flame and the products of combustion, and a fire damper is installed at each floor line.

Exception: Fire dampers are not required in ducts within individual residential dwelling units.

607.7 Flexible ducts and air connectors. Flexible ducts and air connectors shall not pass through any fire-resistance-rated assembly. Flexible air connectors shall not pass through any wall, floor or ceiling.

CHAPTER 9

SPECIFIC APPLIANCES, FIREPLACES AND SOLID FUEL-BURNING EQUIPMENT

SECTION 901 GENERAL

901.1 Scope. This chapter shall govern the approval, design, installation, construction, maintenance, alteration and repair of the appliances and equipment specifically identified herein and factory-built fireplaces. The approval, design, installation, construction, maintenance, alteration and repair of gas-fired appliances shall be regulated by the *International Fuel Gas Code*.

901.2 General. The requirements of this chapter shall apply to the mechanical equipment and appliances regulated by this chapter, in addition to the other requirements of this code.

901.3 Hazardous locations. Fireplaces and solid fuel-burning appliances shall not be installed in hazardous locations.

901.4 Fireplace accessories. Listed fireplace accessories shall be installed in accordance with the conditions of the listing and the manufacturer's installation instructions.

Comm 64.0900 Specific criteria for duct humidifiers.

(1) For duct humidifiers located upstream of final filters in a hospital or ambulatory surgery center, all of the following shall apply:

(a) The duct humidifier shall be located at least 15 feet (4572 mm) upstream of the final filters.

(b) The ductwork with duct-mounted humidifiers shall have a means of water removal.

(c) An adjustable high-limit humidistat shall be located downstream of the humidifier to reduce the potential of condensation inside the duct.

(d) All duct takeoffs shall be sufficiently downstream of the humidifier to ensure complete moisture absorption.

(2) For all other humidifiers located in hospitals or ambulatory surgery centers, all of the following shall apply:

(a) Steam humidifiers shall be used.

(b) Reservoir-type water spray or evaporative pan humidifiers shall not be used.

SECTION 902 MASONRY FIREPLACES

902.1 General. Masonry fireplaces shall be constructed in accordance with the *International Building Code*.

SECTION 903 FACTORY-BUILT FIREPLACES

903.1 General. Factory-built fireplaces shall be listed and labeled and shall be installed in accordance with the conditions of the listing. Factory-built fireplaces shall be tested in accordance with UL 127.

903.2 Hearth extensions. Hearth extensions of approved factory-built fireplaces and fireplace stoves shall be installed in accordance with the listing of the fireplace. The hearth extension shall be readily distinguishable from the surrounding floor area.

903.3 Unvented gas log heaters. An unvented gas log heater shall not be installed in a factory-built fireplace unless the fireplace system has been specifically tested, listed and labeled for such use in accordance with UL 127.

SECTION 904 PELLET FUEL-BURNING APPLIANCES

904.1 General. Pellet fuel-burning appliances shall be listed and labeled and shall be installed in accordance with the terms of the listing.

SECTION 905 FIREPLACE STOVES AND ROOM HEATERS

905.1 General. Fireplace stoves and solid-fuel-type room heaters shall be listed and labeled and shall be installed in accordance with the conditions of the listing. Fireplace stoves shall be tested in accordance with UL 737. Solid-fuel-type room heaters shall be tested in accordance with UL 1482. Fireplace inserts intended for installation in fireplaces shall be listed and labeled in accordance with the requirements of UL 1482 and shall be installed in accordance with the manufacturer's installation instructions.

905.2 Connection to fireplace. The connection of solid fuel appliances to chimney flues serving fireplaces shall comply with Sections 801.7 and 801.10.

SECTION 906 FACTORY-BUILT BARBECUE APPLIANCES

906.1 General. Factory-built barbecue appliances shall be of an approved type and shall be installed in accordance with the manufacturer's installation instructions, this chapter and Chapters 3, 5, 7, 8 and the *International Fuel Gas Code*.

SECTION 907 INCINERATORS AND CREMATORIES

907.1 General. Incinerators and crematories shall be listed and labeled in accordance with UL 791 and shall be installed in accordance with the manufacturer's installation instructions.

SECTION 908
COOLING TOWERS, EVAPORATIVE CONDENSERS AND FLUID COOLERS

908.1 General. A cooling tower used in conjunction with an air-conditioning appliance shall be installed in accordance with the manufacturer's installation instructions.

908.2 Access. Cooling towers, evaporative condensers and fluid coolers shall be provided with ready access.

908.3 Location. Cooling towers, evaporative condensers and fluid coolers shall be located to prevent the discharge vapor plumes from entering occupied spaces. Plume discharges shall be not less than 5 feet (1524 mm) above or 20 feet (6096 mm) away from any ventilation inlet to a building. Location on the property shall be as required for buildings in accordance with the *International Building Code*.

908.4 Support and anchorage. Supports for cooling towers, evaporative condensers and fluid coolers shall be designed in accordance with the *International Building Code*. Seismic restraints shall be as required by the ICC *International Building Code*.

908.5 Water supply. Water supplies and protection shall be as required by the *International Plumbing Code*.

908.6 Drainage. Drains, overflows and blow-down provisions shall be indirectly connected to an approved disposal location. Discharge of chemical waste shall be approved by the appropriate regulatory authority.

908.7 Refrigerants and hazardous fluids. Heat exchange equipment that contains a refrigerant and that is part of a closed refrigeration system shall comply with Chapter 11. Heat exchange equipment containing heat transfer fluids which are flammable, combustible or hazardous shall comply with the *International Fire Code*.

SECTION 909
VENTED WALL FURNACES

909.1 General. Vented wall furnaces shall be installed in accordance with their listing and the manufacturer's installation instructions. Oil-fired furnaces shall be tested in accordance with UL 730.

909.2 Location. Vented wall furnaces shall be located so as not to cause a fire hazard to walls, floors, combustible furnishings or doors. Vented wall furnaces installed between bathrooms and adjoining rooms shall not circulate air from bathrooms to other parts of the building.

909.3 Door swing. Vented wall furnaces shall be located so that a door cannot swing within 12 inches (305 mm) of an air inlet or air outlet of such furnace measured at right angles to the opening. Doorstops or door closers shall not be installed to obtain this clearance.

909.4 Ducts prohibited. Ducts shall not be attached to wall furnaces. Casing extension boots shall not be installed unless listed as part of the appliance.

909.5 Manual shutoff valve. A manual shutoff valve shall be installed ahead of all controls.

909.6 Access. Vented wall furnaces shall be provided with access for cleaning of heating surfaces, removal of burners, replacement of sections, motors, controls, filters and other working parts, and for adjustments and lubrication of parts requiring such attention. Panels, grilles and access doors that must be removed for normal servicing operations shall not be attached to the building construction.

SECTION 910
FLOOR FURNACES

910.1 General. Floor furnaces shall be installed in accordance with their listing and the manufacturer's installation instructions. Oil-fired furnaces shall be tested in accordance with UL 729.

910.2 Placement. Floor furnaces shall not be installed in the floor of any aisle or passageway of any auditorium, public hall, place of assembly, or in any egress element from any such room or space.

With the exception of wall register models, a floor furnace shall not be placed closer than 6 inches (152 mm) to the nearest wall, and wall register models shall not be placed closer than 6 inches (152 mm) to a corner.

The furnace shall be placed such that a drapery or similar combustible object will not be nearer than 12 inches (305 mm) to any portion of the register of the furnace. Floor furnaces shall not be installed in concrete floor construction built on grade. The controlling thermostat for a floor furnace shall be located within the same room or space as the floor furnace or shall be located in an adjacent room or space that is permanently open to the room or space containing the floor furnace.

910.3 Bracing. The floor around the furnace shall be braced and headed with a support framework design in accordance with the *International Building Code*.

910.4 Clearance. The lowest portion of the floor furnace shall have not less than a 6-inch (152 mm) clearance from the grade level; except where the lower 6-inch (152 mm) portion of the floor furnace is sealed by the manufacturer to prevent entrance of water, the minimum clearance shall be reduced to not less than 2 inches (51 mm). Where these clearances are not present, the ground below and to the sides shall be excavated to form a pit under the furnace so that the required clearance is provided beneath the lowest portion of the furnace. A 12-inch (305 mm) minimum clearance shall be provided on all sides except the control side, which shall have an 18-inch (457 mm) minimum clearance.

SECTION 911
DUCT FURNACES

911.1 General. Duct furnaces shall be installed in accordance with the manufacturer's installation instructions. Electric furnaces shall be tested in accordance with UL 1995.

SECTION 912
INFRARED RADIANT HEATERS

912.1 Support. Infrared radiant heaters shall be safely and adequately fixed in an approved position independent of fuel and electric supply lines. Hangers and brackets shall be noncombustible material.

912.2 Clearances. Heaters shall be installed with clearances from combustible material in accordance with the manufacturer's installation instructions.

SECTION 913
CLOTHES DRYERS

913.1 General. Clothes dryers shall be installed in accordance with the manufacturer's installation instructions. Electric residential clothes dryers shall be tested in accordance with an approved test standard. Electric commercial clothes dryers shall be tested in accordance with UL 1240. Electric coin-operated clothes dryers shall be tested in accordance with UL 2158.

913.2 Exhaust required. Clothes dryers shall be exhausted in accordance with Section 504.

913.3 Clearances. Clothes dryers shall be installed with clearance to combustibles in accordance with the manufacturer's instructions.

SECTION 914
SAUNA HEATERS

914.1 Location and protection. Sauna heaters shall be located so as to minimize the possibility of accidental contact by a person in the room.

914.1.1 Guards. Sauna heaters shall be protected from accidental contact by an approved guard or barrier of material having a low coefficient of thermal conductivity. The guard shall not substantially affect the transfer of heat from the heater to the room.

914.2 Installation. Sauna heaters shall be listed and labeled and shall be installed in accordance with their listing and the manufacturer's installation instructions.

914.3 Access. Panels, grilles and access doors that are required to be removed for normal servicing operations shall not be attached to the building.

914.4 Heat and time controls. Sauna heaters shall be equipped with a thermostat that will limit room temperature to 194°F (90°C). If the thermostat is not an integral part of the sauna heater, the heat-sensing element shall be located within 6 inches (152 mm) of the ceiling. If the heat-sensing element is a capillary tube and bulb, the assembly shall be attached to the wall or other support, and shall be protected against physical damage.

914.4.1 Timers. A timer, if provided to control main burner operation, shall have a maximum operating time of 1 hour. The control for the timer shall be located outside the sauna room.

914.5 Sauna room. A ventilation opening into the sauna room shall be provided. The opening shall be not less than 4 inches by 8 inches (102 mm by 203 mm) located near the top of the door into the sauna room.

914.5.1 Warning notice. The following permanent notice, constructed of approved material, shall be mechanically attached to the sauna room on the outside:

WARNING: DO NOT EXCEED 30 MINUTES IN SAUNA. EXCESSIVE EXPOSURE CAN BE HARMFUL TO HEALTH. ANY PERSON WITH POOR HEALTH SHOULD CONSULT A PHYSICIAN BEFORE USING SAUNA.

The words shall contrast with the background and the wording shall be in letters not less than 0.25-inch (6.4 mm) high.

Exception: This section shall not apply to one- and two-family dwellings.

SECTION 915
ENGINE AND GAS TURBINE-POWERED EQUIPMENT AND APPLIANCES

915.1 General. The installation of liquid-fueled stationary internal combustion engines and gas turbines, including fuel storage and piping, shall meet the requirements of NFPA 37.

915.2 Powered equipment and appliances. Permanently installed equipment and appliances powered by internal combustion engines and turbines shall be installed in accordance with the manufacturer's installation instructions and NFPA 37.

SECTION 916
POOL AND SPA HEATERS

916.1 General. Pool and spa heaters shall be installed in accordance with the manufacturer's instructions. Oil-fired pool heaters shall be tested in accordance with UL 726.

SECTION 917
COOKING APPLIANCES

917.1 Cooking appliances. Cooking appliances that are designed for permanent installation, including ranges, ovens, stoves, broilers, grills, fryers, griddles and barbecues, shall be listed, labeled and installed in accordance with the manufacturer's installation instructions. Oil-burning stoves shall be tested in accordance with UL 896. Solid fuel-fired ovens shall be tested in accordance with UL 2162.

917.2 Prohibited location. Cooking appliances designed, tested, listed and labeled for use in commercial occupancies shall not be installed within dwelling units or within any area where domestic cooking operations occur.

917.3 Domestic appliances. Cooking appliances installed within dwelling units and within areas where domestic cooking operations occur shall be listed and labeled as household-type appliances for domestic use.

SECTION 918
FORCED-AIR WARM-AIR FURNACES

918.1 Forced-air furnaces. Forced-air furnaces shall be installed in accordance with the listings and the manufacturer's installation instructions. Oil-fired furnaces shall be tested in accordance with UL 727. Electric furnaces shall be tested in accordance with UL 1096 or UL 1995. Solid fuel furnaces shall be tested in accordance with UL 391.

918.2 Minimum duct sizes. The minimum unobstructed total area of the outside and return air ducts or openings to a forced-air warm-air furnace shall be not less than 2 square inches per 1,000 Btu/h (4402 mm^2/kW) output rating capacity of the furnace and not less than that specified in the furnace manufacturer's installation instructions. The minimum unobstructed total area of supply ducts from a forced-air warm-air furnace shall not be less than 2 square inches for each 1,000 Btu/h (4402 mm^2/kW) output rating capacity of the furnace and not less than that specified in the furnace manufacturer's installation instructions.

Exception: The total area of the supply air ducts and outside and return air ducts shall not be required to be larger than the minimum size required by the furnace manufacturer's installation instructions.

918.3 Heat pumps. The minimum unobstructed total area of the outside and return air ducts or openings to a heat pump shall be not less than 6 square inches per 1,000 Btu/h (13 208 mm^2/kW) output rating or as indicated by the conditions of listing of the heat pump. Electric heat pumps shall be tested in accordance with UL 559 or UL 1995.

918.4 Dampers. Volume dampers shall not be placed in the air inlet to a furnace in a manner that will reduce the required air to the furnace.

918.5 Circulating air ducts for forced-air warm-air furnaces. Circulating air for fuel-burning, forced-air-type, warm-air furnaces shall be conducted into the blower housing from outside the furnace enclosure by continuous air-tight ducts.

918.6 [Comm 64.0918] Prohibited sources. Outside or return air for a forced-air heating system shall not be taken from the following locations:

1. Closer than 10 feet (3048 mm) from any appliance vent outlet, a vent opening from a plumbing drainage system or the discharge outlet of an exhaust fan, unless the outlet is 2 feet (610 mm) above the outside air inlet.
2. Where located less than 10 feet (3048 mm) above the surface of any abutting public way or driveway, or at grade level by a sidewalk, street, alley or driveway.
3. A hazardous or insanitary location or a refrigeration machinery room as defined in this code.
4. A room or space, the volume of which is less than 25 percent of the entire volume served by such system. Where connected by a permanent opening having an area sized in accordance with Sections 918.2 and 918.3, adjoining rooms or spaces shall be considered as a single room or space for the purpose of determining the volume of such rooms or spaces.

   Exception: The minimum volume requirement shall not apply where the amount of return air taken from a room or space is less than or equal to the amount of supply air delivered to such room or space.
5. A closet, bathroom, toilet room, kitchen, garage, mechanical room, boiler room or furnace room.
6. A room or space containing a fuel-burning appliance where such room or space serves as the sole source of return air.

   Exceptions:

   1. This shall not apply where the fuel-burning appliance is a direct-vent appliance.
   2. This shall not apply where the room or space complies with the following requirements:
      2.1. The return air shall be taken from a room or space having a volume exceeding 1 cubic foot for each 10 Btu/h (9.6 L/W) of combined input rating of all fuel-burning appliances therein.
      2.2. The volume of supply air discharged back into the same space shall be approximately equal to the volume of return air taken from the space.
      2.3. Return-air inlets shall not be located within 10 feet (3048 mm) of any appliance firebox or draft hood in the same room or space.
   3. This shall not apply to rooms or spaces containing solid fuel-burning appliances, provided that return-air inlets are located not less than 10 feet (3048 mm) from the firebox of such appliances.

Comm 64.0918 Forced-air warm-air furnaces. (1) The outside air intake openings shall be located at least 12 inches (305 mm) vertical from the adjoining grade level.

918.7 Outside opening protection. Outdoor air intake openings shall be protected in accordance with Section 401.6.

918.8 Return-air limitation. Return air from one dwelling unit shall not be discharged into another dwelling unit.

SECTION 919
CONVERSION BURNERS

919.1 Conversion burners. The installation of conversion burners shall conform to ANSI Z21.8.

SECTION 920
UNIT HEATERS

920.1 General. Unit heaters shall be installed in accordance with the listing and the manufacturer's installation instructions. Oil-fired unit heaters shall be tested in accordance with UL 731.

920.2 Support. Suspended-type unit heaters shall be supported by elements that are designed and constructed to accommodate the weight and dynamic loads. Hangers and brackets shall be of noncombustible material. Suspended-type oil-fired unit heaters shall be installed in accordance with NFPA 31.

920.3 Ductwork. A unit heater shall not be attached to a warm-air duct system unless listed for such installation.

SECTION 921
VENTED ROOM HEATERS

921.1 General. Vented room heaters shall be listed and labeled and shall be installed in accordance with the conditions of the listing and the manufacturer's instructions.

SECTION 922
KEROSENE AND OIL-FIRED STOVES

922.1 General. Kerosene and oil-fired stoves shall be listed and labeled and shall be installed in accordance with the conditions of the listing and the manufacturer's installation instructions. Kerosene and oil-fired stoves shall comply with NFPA 31. Oil-fired stoves shall be tested in accordance with UL 896.

SECTION 923
SMALL CERAMIC KILNS

923.1 General. The provisions of this section shall apply to kilns that are used for ceramics, have a maximum interior volume of 20 cubic feet (0.566 m^3) and are used for hobby and non-commercial purposes.

923.1.1 Installation. Kilns shall be installed in accordance with the manufacturer's installation instructions and the provisions of this code.

SECTION 924
STATIONARY FUEL CELL POWER PLANTS

924.1 General. Stationary fuel cell power plants having a power output not exceeding 1,000 kW, shall be tested in accordance with ANSI Z21.83 and shall be installed in accordance with the manufacturer's installation instructions.

CHAPTER 15
REFERENCED STANDARDS

This chapter lists the standards that are referenced in various sections of this document. The standards are listed herein by the promulgating agency of the standard, the standard identification, the effective date and title, and the section or sections of this document that reference the standard. The application of the referenced standards shall be as specified in Section 102.8.

AIA

The American Institute of Architects
9 Jay Gould Court, Box 753
Waldorf, MD 20601

Standard reference number	Title	Referenced in code section number
	AIA Guidelines for Design and Construction of Hospital and Health Care Facilities, 1996-97 [Comm 64.1500 (2)]	Table 64.0403, Comm 64.0605 (1)

ANSI

American National Standards Institute
25 West 43rd Street, Fourth Floor
New York, NY 10036

Standard reference number	Title	Referenced in code section number
Z21.8—94	Installation of Domestic Gas Conversion Burners	919.1
Z21.83—98	Fuel Cell Power Plants	924.1

ASHRAE

American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
1791 Tullie Circle, NE
Atlanta, GA 30329-2305

Standard reference number	Title	Referenced in code section number
ASHRAE—97	Handbook of Fundamentals	312.1
34—97	Number Designation and Safety Classification of Refrigerants—with Addenda through 1997	202

ASME

American Society of Mechanical Engineers
Three Park Avenue
New York, NY 10016-5990

Standard reference number	Title	Referenced in code section number
B16.18—84	Cast Copper Alloy Solder Joint Pressure Fittings	513.13.1
B16.22—95	Wrought Copper and Copper Alloy Solder Joint Pressure Fittings —with B16.22a-98 Addendum	513.13.1
ASME—98	Boiler & Pressure Vessel Code (Sections I, II, IV, V & VI)	1004.1, 1011.1
ASME CSD-1	Controls And Safety Devices for Automatically Fired Boilers	1004.1

ASTM

ASTM International
100 Barr Harbor Drive
West Conshohocken, PA 19428

Standard reference number	Title	Referenced in code section number
B 42—98	Specification for Seamless Copper Pipe, Standard Sizes	513.13.1
B 43—98	Specification for Seamless Red Brass Pipe, Standard Sizes	513.13.1
B 68—95	Specification for Seamless Copper Tube, Bright Annealed	513.13.1
B 88—96	Specification for Seamless Copper Water Tube	513.13.1
B 251—97	Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube	513.13.1
B 280—98	Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service	513.13.1
C 315—98b	Specification for Clay Flue Linings	801.16.1, Table 803.10.4
C 411—97	Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation	604.3
D 56—98a	Test Method for Flash Point by Tag Closed Tester	202
D 93—99	Test Method for Flash Point of Pensky-Martens Closed Tester	202
D 2412—96	Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading	603.7.4
D 3278—96e^{01}	Test Methods for Flash Point of Liquids by Setaflash-Closed-Cup Apparatus	202
E 84—98e^{01}	Test Method for Surface Burning Characteristics of Building Materials	202, 510.8, 602.2.1, 604.3
E119—98	Test Method for Fire Tests of Building Construction and Materials	607.5.2
E 136—98e^{01}	Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C	202
E 814—97	Test Method for Fire Tests of Through-Penetration Fire Stops	506.3.11

DOL

Department of Labor
Occupational Safety and Health Administration
c/o Superintendent of Docments
U.S. Government Printing Office
Washington, DC 20402-9325

Standard Reference Number	Title	Referenced in code section number
29 CFR; 1910.1000—74	Air Contaminants	502.5

ICC

International Code Council, Inc.
5203 Leesburg Pike, Suite 600
Falls Church, VA 22041-3401

Standard reference number	Title	Referenced in code section number
EC—2000	ICC Electrical Code™—Administrative Provisions	201.3, 301.7, 306.3.1, 306.4.1, 513.11, 513.12.1, 602.2.1.1
IBC—2000	International Building Code®	201.3, 202, 301.12, 301.13, 301.15, 301.16, 302.1, 302.2, 304.6, 304.9, 308.8, 308.10, 401.4, 401.6, 402.1, 406.1, 502.9, 502.9.1, 504.2, 506.3.4, 506.3.11, 506.3.13.2, 506.4.1, 509.1, 510.6, 510.7, 511.1.5, 513.1, 513.2, 513.3, 513.4.3, 513.5, 513.5.2, 513.5.2.1, 513.6.2, 513.10.5, 513.12, 513.12.2, 513.20, 601.2, 602.3, 603.1, 603.9, 604.4, 606.2.1, 607.1.1, 607.5.1, 607.5.2, 607.5.3, 607.6, 607.5.4, 607.5.4.1, 701.4.1, 701.4.2, 801.3, 801.16.1, 801.18.4, 902.1, 908.3, 908.4, 910.3, 911.3, 1004.6, 1402.3, 1402.3.1
IECC—2000	International Energy Conservation Code®	301.2, 303.3, 312.1, 603.8, 604.1
IFC—2000	International Fire Code®	201.3, 310.1, 311.1, 502.6.2, 502.7.1, 502.8.5, 502.8.5.2, 502.8.5.3, 502.8.8.2, 502.8.8.3, 502.8.8.5, 502.8.8.6, 502.9, 502.9.3, 502.15.2, 509.1, 510.2.1, 510.2.2, 510.4, 513.12.1, 513.12.2, 513.15, 513.16, 513.17, 513.18, 513.19, 513.20.2, 513.20.3, 908.7
IFGC—2000	International Fuel Gas Code®	201.3, 301.3, 701.1, 801.1, 901.1, 906.1
IPC—2000	International Plumbing Code®	201.3, 301.8, 512.2, 908.5, 1002.1, 1002.2, 1002.3, 1005.2, 1006.6, 1008.2, 1009.3, 1401.2

MSS

Manufacturers Standardization Society of the Valve & Fittings Industry, Inc.
127 Park Street, N.E.
Vienna, VA 22180

Standard reference number	Title	Referenced in code section number
SP-69—96	Pipe Hangers and Supports	305.4

NAIMA

North American Insulation Manufacturers Association
Suite 310
44 Canal Center Plaza
Alexandria, VA 22314

Standard reference number	Title	Referenced in code section number
AH116—97	Fibrous Glass Duct Construction Standards	603.4

NFPA

National Fire Protection Association
Batterymarch Park
Quincy, MA 02269

Standard reference number	Title	Referenced in code section number
13—99	Installation of Sprinkler Systems [Comm 64.1500(1)]	513.12.3
31—01	Installation of Oil-Burning Equipment [Comm 64.1500(1)]	801.2.1, 801.18.1, 801.18.2, 920.2, 922.1
37—98	Stationary Combustion Engines and Gas Turbines	915.1, 915.2
58—98	Liquefied Petroleum Gas Code	502.8.10
69—97	Explosion Prevention Systems	510.8.3
72—99	National Fire Alarm Code [Comm 64.1500(1)]	606.3, 607.2
82—99	Incinerators, Waste and Linen Handling Systems and Equipment	601.1
88B—97	Repair Garages	304.4
91—99	Exhaust Systems for Air Conveying of Materials	502.8.5.1, 502.16
211—96	Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances	806.1
704—96	Identification of the Hazards of Materials for Emergency Response	502.7.4, 510.1
8501—97	Single Burner Boiler Operation	1004.1
8502—99	Prevention of Furnace Explosions/Implosions in Multiple Burner Boiler-Furnaces	1004.1
8504—96	Atmospheric Fluidized-Bed Boiler Operation	1004.1

SMACNA

Sheet Metal & Air Conditioning Contractors National Assoc., Inc.
4021 Lafayette Center Road
Chantilly, VA 22021

Standard reference number	Title	Referenced in code section number
SMACNA—95	HVAC Duct Construction Standards—Metal and Flexible; Addendum number 1, November 1997	603.3
SMACNA—92	Fibrous Glass Duct Construction Standards	603.4

UL

Underwriters Laboratories Inc.
333 Pfingsten Road
Northbrook, IL 60062-2096

Standard reference number	Title	Referenced in code section number
17—94	Vent or Chimney Connector Dampers for Oil-Fired Appliances—with Revisions thru September 1998	803.6
103—95	Chimneys, Factory-Built, Residential Type and Building Heating Appliance—with Revisions thru March 1999	805.2
127—96	Factory-Built Fireplaces—with Revisions thru January 1998	805.3, 903.1, 903.3
174—96	Household Electric Storage Tank Water Heaters	1002.1
181—96	Factory-made Air Ducts and Air Connectors —with Revisions thru December 1998	512.2, 603.4, 603.5.1, 603.5.2, 604.13
300—96	Fire Testing of Fire Extinguishing Systems for Protection of Restaurant Cooking Areas	509.3
391—95	Solid-Fuel and Combination-Fuel Central and Supplementary Furnaces—with Revisions thru June 1997	918.1
555—95	Fire Dampers	607.3
555C—96	Ceiling Dampers	607.6.2, 607.3
555S—96	Leakage Rated Dampers for Use in Smoke Control Systems	607.3.1.1, 607.3
641—95	Low-Temperature Venting Systems, Type L	802.1
710—95	Exhaust Hoods for Commercial Cooking Equipment	507.1, 507.7.1
726—95	Oil-Fired Boiler Assemblies—with Revisions thru January 1999	916.1
727—94	Oil-Fired Central Furnaces—with Revisions thru January 1999	918.1
729—94	Oil-Fired Floor Furnaces—with Revisions thru August 1995	910.1
730—94	Oil-Fired Wall Furnaces—with Revisions thru January 1999	909.1
731—95	Oil-Fired Unit Heaters—with Revisions thru January 1999	920.1
732—95	Oil-Fired Storage Tank Water Heaters	1002.1
737—96	Fireplace Stoves—with Revisions thru June 1998	805.2, 905.1
791—93	Residential Incinerators—with Revisions thru May 1998	907.1
834—95	Heating, Water Supply and Power Boilers—Electric—With Revisions Thru August 1997	1004.1
896—93	Oil-Burning Stoves—with Revisions thru April 1997	916.1, 917.1, 922.1
910—98	Test for Flame-Propagation and Smoke-Density Values for Electrical and Optical-Fiber Cables Use in Space Transporting Environmental Air	602.2.1.1
959—95	Medium Heat Appliance Factory Built Chimneys—with Revisions thru April 1998	805.5
1240—94	Electric Commercial Clothes Drying Equipment—with Revisions thru October 1998	913.1
1453—95	Electronic Booster and Commercial Storage Tank Water Heaters	1002.1
1482—96	Room Heaters, Solid-Fuel Type—with Revisions thru September 1998	905.1
1777—96	Chimney Liners—with Revisions thru August 1998	801.16.1, 801.18.4
1820—96	Fire Test of Pneumatic Tubing for Flame and Smoke Characteristics	602.2.1.3
1887—96	Fire Tests of Plastic Sprinkler Pipe for Flame and Smoke Characteristics—with Revisions thru April 1998	602.2.1.2
1995—95	Heating and Cooling Equipment—with Revisions thru July 1998	911.1, 918.1, 918.3
2043—96	Fire Test for Heat and Visible Smoke Release for Discrete Products and their Accessories Installed in Air-Handling Spaces	602.2.1.4
2158—97	Electric Clothes Dryer—with Revisions June 1997	913.1
2162—94	Outline of Investigation for Commercial Wood-Fired Baking Ovens—Refractory Type	917.1

(Note: UL 303-97, UL 465-82, UL 559-85 & UL 1096-86 are replaced by UL 1995-95 and UL 1556-90 is replaced by 2158-97.)

Part FG – The IFGC, as Modified by Chapter Comm 65

TABLE OF CONTENTS